DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
INTEGRATED PRODUCT TEAM WEST
2001 JUNIPERO SERRA BOULEVARD, SUITE 600
DALY CITY, CALIFORNIA 94014-1976

IN REPLY REFER TO:

Ser 05/767
November 2, 2005

Mr. Phillip A. Ramsey
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

Re: FINAL SAMPLING AND ANALYSIS PLAN ADDITIONAL INVESTIGATION AT SITE 22- SOUTHWEST FENCE LINE AND SEAL CREEK, NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD, CONCORD, CALIFORNIA

Dear Mr. Ramsey:

In accordance with Sections 10.2 (a), 10.3 (c), and 10.9 of the Federal Facility Agreement (FFA), enclosed please find for your information and records the "*Final Sampling and Analysis Plan (Field Sampling Plan/Quality Assurance Project Plan) Additional Investigation at Site 22-Southwest Fence Line and Seal Creek, Naval Weapons Station Seal Beach, Detachment Concord*" dated November 2, 2005 (final SAP). Per Section 22.3 of the FFA, the U.S. Environmental Protection Agency (EPA) initiated the "informal dispute resolution" process on September 12, 2005 over concerns it had with the draft final version of this SAP. This final version incorporates changes to the draft final SAP of September 1, 2005 resulting from informal discussions between the EPA and Navy project managers. Meetings between the EPA and Navy took place on the 22nd and 23rd of September 2005, and included a site visit on the 23rd. For convenience, Appendix G of the final SAP includes the Navy's responses to comments on both the draft and draft final versions of the SAP.

If there are any questions regarding the enclosed document, please contact me at telephone No. 650-746-7451 or Internet e-mail: stephen.f.tyahla@navy.mil.

Sincerely,

Stephen F. Tyahla, P.E., CHMM
Lead Remedial Project Manager

Enclosure
Copy to:
U.S. Environmental Protection Agency, Region 9 (Attn: Sonce de Vries)
U.S. Fish and Wildlife Services (Attn: Dan Welsh)
National Oceanic and Atmospheric Administration (Attn: Denise Klimas)

November 2, 2005

Re: FINAL SAMPLING AND ANALYSIS PLAN ADDITIONAL INVESTIGATION AT SITE 22- SOUTHWEST FENCE LINE AND SEAL CREEK, NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD, CONCORD, CALIFORNIA

Copy to (continued):
National Oceanic and Atmospheric Administration (Attn: Laurie Sullivan)
California Department of Toxic Substances Control Region 1 (Attn: Jim Pinasco)
California Regional Water Quality Control Board, SFBAY (Attn: Laurent Meillier)
California Department of Fish and Game (Attn: Frank Gray)
Restoration Advisory Board (RAB) Co-Chair (Attn: Ms. Mary Lou Williams)
RAB Member Lisa Anich
RAB Member Kevin Cornish
RAB Member Dwayne Dalman
RAB Member David Griffith
RAB Member Gregory Glaser
RAB Member Jessica Hamburger
RAB Member Mario Menesini
RAB Member Igor Skaredoff
Tech Law, Inc. (Attn: Kimberly Walsh)
NWS Seal Beach, N45WS (Attn: Margaret Wallerstein)
NWS Seal Beach, N09WS (Attn: Gregg Smith)
NAVFAC Southwest (3) (Diane Silva- Admin Record/IR/Base copy)
TtEMI San Francisco (Attn: Joanna Canepa)
TtEMI San Francisco (Attn: Penny Wilson)

Final

Sampling and Analysis Plan

(Field Sampling Plan/Quality Assurance Project Plan)

Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek

Naval Weapons Station Seal Beach
Detachment Concord
Concord, California

November 2, 2005

Prepared for:

Department of the Navy
Integrated Product Team West
Daly City, California

Prepared by:

Tetra Tech EM Inc.
135 Main Street, Suite 1800
San Francisco, California 94105

Prepared under:

General Services Administration
Contract Number 10F-0076K
Order No. N62474-03-F-4023

GSA.029.00026

Final

Sampling and Analysis Plan
(Field Sampling Plan/Quality Assurance Project Plan)
Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek
Naval Weapons Station Seal Beach Detachment Concord
Concord, California

Contract Number 10F-0076K
GSA.029.00025

Prepared for:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Tetra Tech

Program QA Manager: Kevin Hoch for — Greg Swanson, Tetra Tech — Date: 21-Oct-2005

Navy QA Officer: Narciso Allison Ancog — Narciso A. Ancog — Date: 10/28/2005

DISTRIBUTION LIST

Name	Responsibility	Affiliation
Steve Tyahla	Remedial Project Manager	Integrated Product Team West, Naval Facilities Engineering Command, Southwest
Margaret Wallerstein	Installation Restoration Manager	Naval Weapons Station Seal Beach
Narciso A. Ancog	Quality Assurance (QA) Officer	Naval Facilities Engineering Command, Southwest
Phillip Ramsey	Remedial Project Manager	U.S. Environmental Protection Agency, Region 9
Jim Pinasco	Remedial Project Manager	California Environmental Protection Agency, Department of Toxic Substances Control
Laurent Meillier	Remedial Project Manager	California Regional Water Quality Control Board, San Francisco Bay
Greg Swanson	Program QA Manager	Tetra Tech EM Inc.
Kevin Hoch	Project QA Officer	Tetra Tech EM Inc.
Joanna Canepa	Program Manager	Tetra Tech EM Inc.
Penny Wilson	Project Manager	Tetra Tech EM Inc.
Sara Woolley	Analytical Coordinator	Tetra Tech EM Inc.
Roy Glenn	Field Team Leader	Tetra Tech EM Inc.

TABLE 1: ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP

Final SAP, Additional Investigation at Site 22 - Southwest Fence Line and Seal Creek, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

EPA QA/R-5 QAPP ELEMENT[a]		SAP	
A1	Title and Approval Sheet	Title and Approval Sheet	
A2	Table of Contents	Table of Contents	
A3	Distribution List	Distribution List	
A4	Project/Task Organization	1.4	Project Organization
A5	Problem Definition/Background	1.1	Problem Definition and Background
A6	Project/Task Description	1.2	Project Description
A7	Quality Objectives and Criteria	1.3	Quality Objectives and Criteria
A8	Special Training/Certification	1.5	Special Training and Certification
A9	Documents and Records	1.6	Documents and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody
B4	Analytical Methods	2.4	Analytical Methods
B5	Quality Control	2.5	Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Equipment Testing, Inspection, and Maintenance
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Inspection and Acceptance of Supplies and Consumables
B9	Non-direct Measurements	2.9	Nondirect Measurements
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review, Verification, and Validation
D2	Validation and Verification Methods		
D3	Reconciliation with User Requirements	4.2	Reconciliation with User Requirements

Notes:

a EPA. 2001. "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5." Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.

EPA U.S. Environmental Protection Agency

QAPP Quality assurance project plan

SAP Sampling and analysis plan

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

Appendix

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
%R	Percent recovery
29 CFR	Title 29 of the *Code of Federal Regulations*
APHA	American Public Health Association
ATSDR	Agency for Toxic Substance and Disease Registry
BEPH	Bis(2-ethylhexyl)phthalate
bgs	Below ground surface
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COC	Chain of custody
Detachment Concord	Naval Weapons Station Seal Beach Detachment
DHS	Department of Health Services
DNT	Dinitrotoluene
DO	Delivery Order
DQA	Data quality assessment
DQO	Data quality objective
DTSC	Department of Toxic Substances Control
EDD	Electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
FSP	Field sampling plan
FTL	Field team leader
GPC	Gel permeation chromatography
GPS	Global positioning system
HASP	Health and safety plan
HBX	High brissance seraphim
HMX	Cyclotetramethylene-tetranitramine (the abbreviation is for “high melting explosive”)
IAS	Initial assessment study
ICP	Inductively coupled plasma
ID	Identification
IDL	Instrument detection limit

ACRONYMS AND ABBREVIATIONS (Continued)

IDW	Investigation-derived waste
IR	Installation restoration
IW	Industrial wastewater
L	Liter
L/min	Liter per minute
LCS	Laboratory control sample
LIMS	Laboratory information management system
MCAWW	Methods for Chemical Analysis of Water and Waste
MCL	Maximum contaminant level
MDL	Method detection limit
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mL	Milliliter
MQO	Measurement quality objective
MS	Matrix spike
MSD	Matrix spike duplicate
msl	Mean sea level
MSR	Monthly status report
NEDTS	Navy Environmental Data Transfer Standards
NFESC	Naval Facilities Engineering Service Center
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PCB	Polychlorinated biphenyls
PE	Performance evaluation
PHA	Public health assessment
PID	Photoionization detector
PPE	Personal protective equipment
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
PRRL	Project-required reporting limit
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
QCSR	Quality control summary report

ACRONYMS AND ABBREVIATIONS (Continued)

RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylene trinitramine
RFA	RCRA facility assessment
RPD	Relative percent difference
RI	Remedial investigation
RPM	Remedial project manager
RTC	Response to comment
SAP	Sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SDG	Sample delivery group
SFBRWQCB	California Regional Water Quality Control Board
SI	Site inspection
SOP	Standard operating procedure
SOW	Statement of work
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
SWAMP	Surface Water Ambient Monitoring Program
SWMU	Solid waste management unit
TCE	Trichloroethene
Tetra Tech	Tetra Tech EM Inc.
TIC	Tentatively identified compound
TNT	2,4,6-Trinitrotoluene
TPH	Total petroleum hydrocarbons
TSA	Technical systems audit
UST	Underground storage tank
VOC	Volatile organic compound

1.0 PROJECT DESCRIPTION AND MANAGEMENT

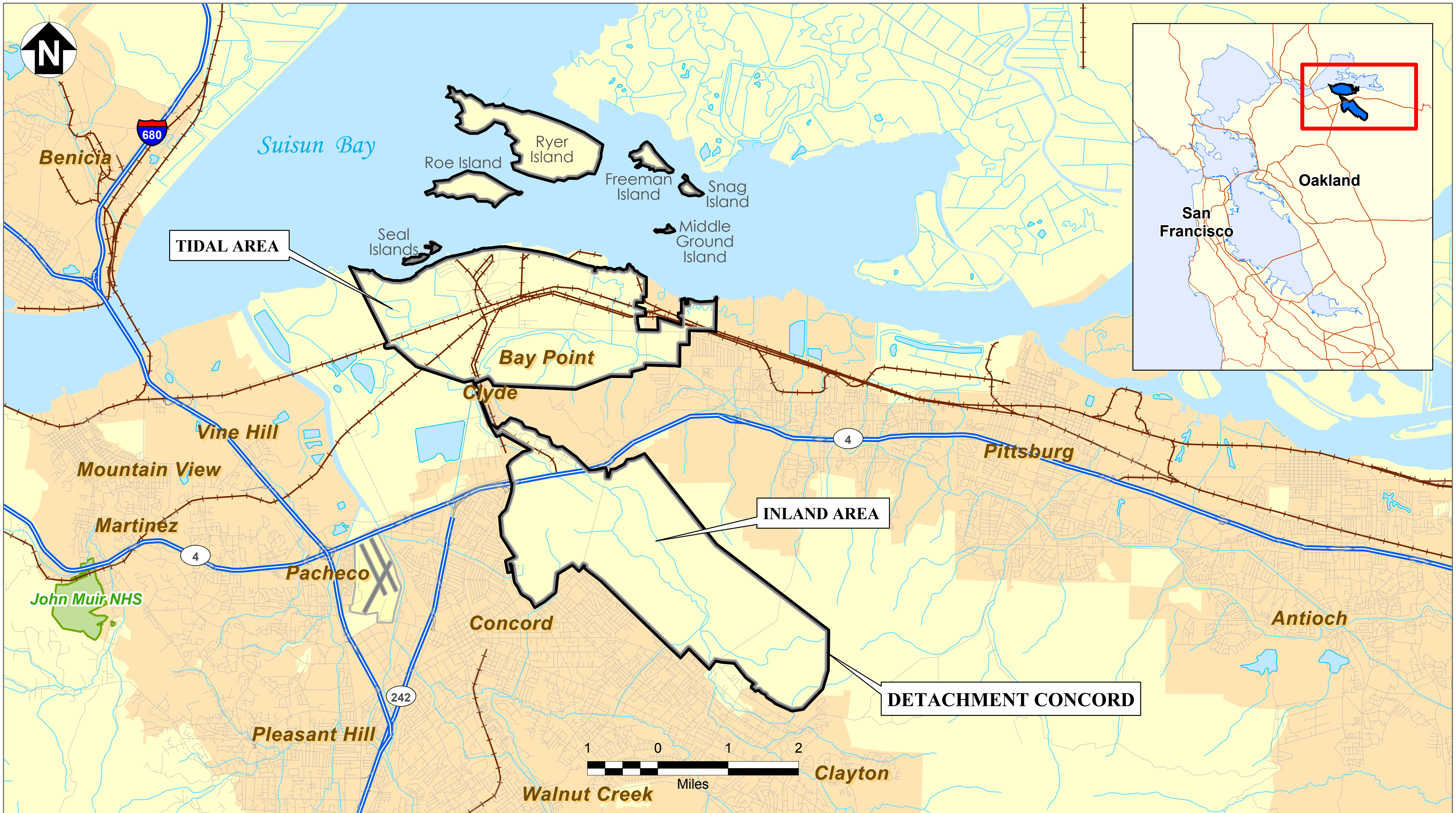
Tetra Tech EM Inc. (Tetra Tech) has prepared this "Draft Sampling and Analysis Plan (SAP) (Field Sampling Plan and Quality Assurance Project Plan) for Additional Investigation at Site 22 - Southwest Fence Line and Seal Creek" at the direction of the U.S. Department of the Navy, Naval Facilities Engineering Command, Integrated Product Team West, under General Services Administration Contract No. GS-10F-0076K. As part of this work, Tetra Tech will collect surface soil and sediment samples near Site 22, located in the in the Inland Area of Naval Weapons Station Seal Beach Detachment Concord (Detachment Concord) in Concord, California (Figures 1 and 2).

The Navy will sample the following areas as part of this investigation: (1) the off-site properties southwest of the Site 22 fence line, (2) Mount Diablo/Seal Creek, (3) low-lying areas within the western portion of Site 22, (4) the southeastern portion of Site 22 (within the abandoned Clayton Canal), and (5) four separate magazine areas located in the Inland Area (referred to in this report as Magazine A, Magazine B, Magazine C, and Magazine D) (Figures 2 and 3).

Site 22 currently consists of 531 acres and includes 13 buildings and 250 munitions storage magazines connected by a series of parallel roads and railroad spurs and surrounding open grassland (Figure 4). Initially, the site investigation focused on Building 7SH5, a former missile and wing repair facility. However, elevated concentrations of arsenic were detected at concentrations exceeding the ambient value of 10 milligrams per kilogram (mg/kg) in surface soil samples collected from locations in the open grasslands near Building 7SH5 (Tetra Tech 1997). In addition, no known source of arsenic was identified at Building 7SH5. As a result, the investigation area was later expanded to include the adjacent 250 magazines.

During review of potential sources of arsenic in the Inland Area, the Navy identified a historical newspaper article (*Contra Costa Gazette* 1947), which indicated that an herbicide, "sodium arsenite," that contained arsenic was used on "undergrowth on top and within 50 feet of munitions [magazines] to kill tall grass" that represented a fire hazard (*Contra Costa Gazette* 1947). Based on this article, the Navy hypothesized that the source of arsenic at the Site 22 magazine was the result of the widespread application of arsenic-containing herbicides, either by the Navy or previous owners who used the land for farming. Inorganic arsenate was a commonly applied pesticide in the pre-world war II era (University of Iowa College of Public Health 2003), and its primary use was as a pesticide on cotton fields and orchards [Agency for Toxic Substances and Disease Registry (ATSDR) 2004]. Aerial photographs from 1939 indicate that the land encompassing Site 22 as well as the adjacent off-site properties were used for agriculture, including apple orchards.

The Navy collected samples in June and July 2004 to test the hypothesis that the source of arsenic was widespread application of an arsenic-containing herbicide. The results of the investigation indicated the presence of uniformly elevated concentrations of arsenic (above ambient levels) in surface samples collected in the grasslands of the Site 22 Magazine Area, while concentrations of arsenic outside the study boundary and at depth were significantly lower (consistent with ambient concentrations) (Figures 4 and 5). The distribution of arsenic in soil at Site 22 suggested a pattern consistent with surface application of herbicides.

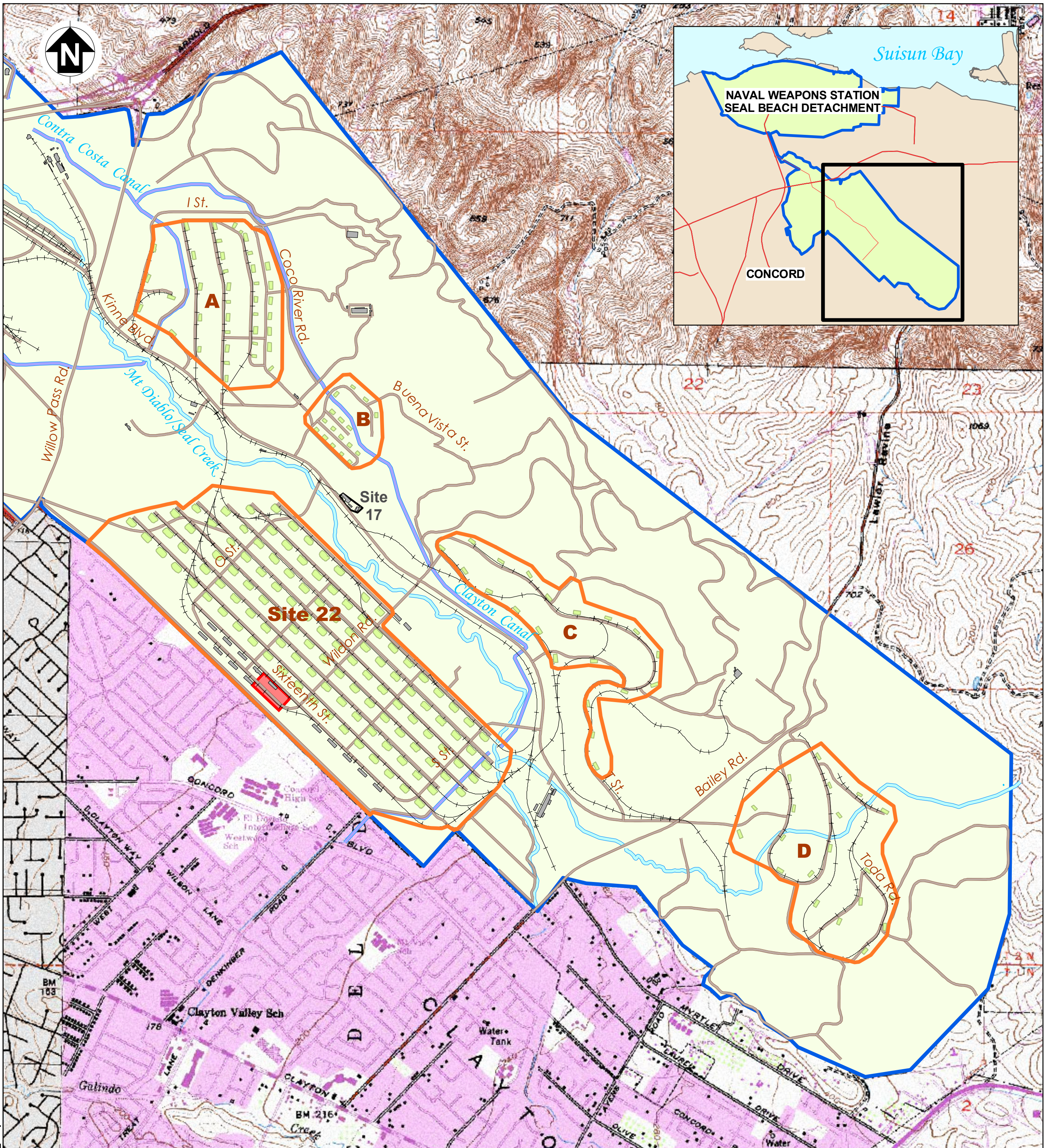


Tetra Tech EM Inc.

NAVAL WEAPONS STATION SEAL BEACH,
DETACHMENT CONCORD
(DETACHMENT CONCORD,
FORMERLY THE CONCORD NAVAL WEAPONS STATION)

DETACHMENT CONCORD
FIGURE 1 LOCATION MAP

2005-08-05 V:\Concord\Projects\RI_Site 22\Vicinity_Map.mxd TtEMI-SF Aleksandr Zhuk



- Detachment Concord Boundary
- Ammunition Magazine Area
- Ammunition Magazine
- Building 7SH5 Study Area
- Building
- Railroad
- Street

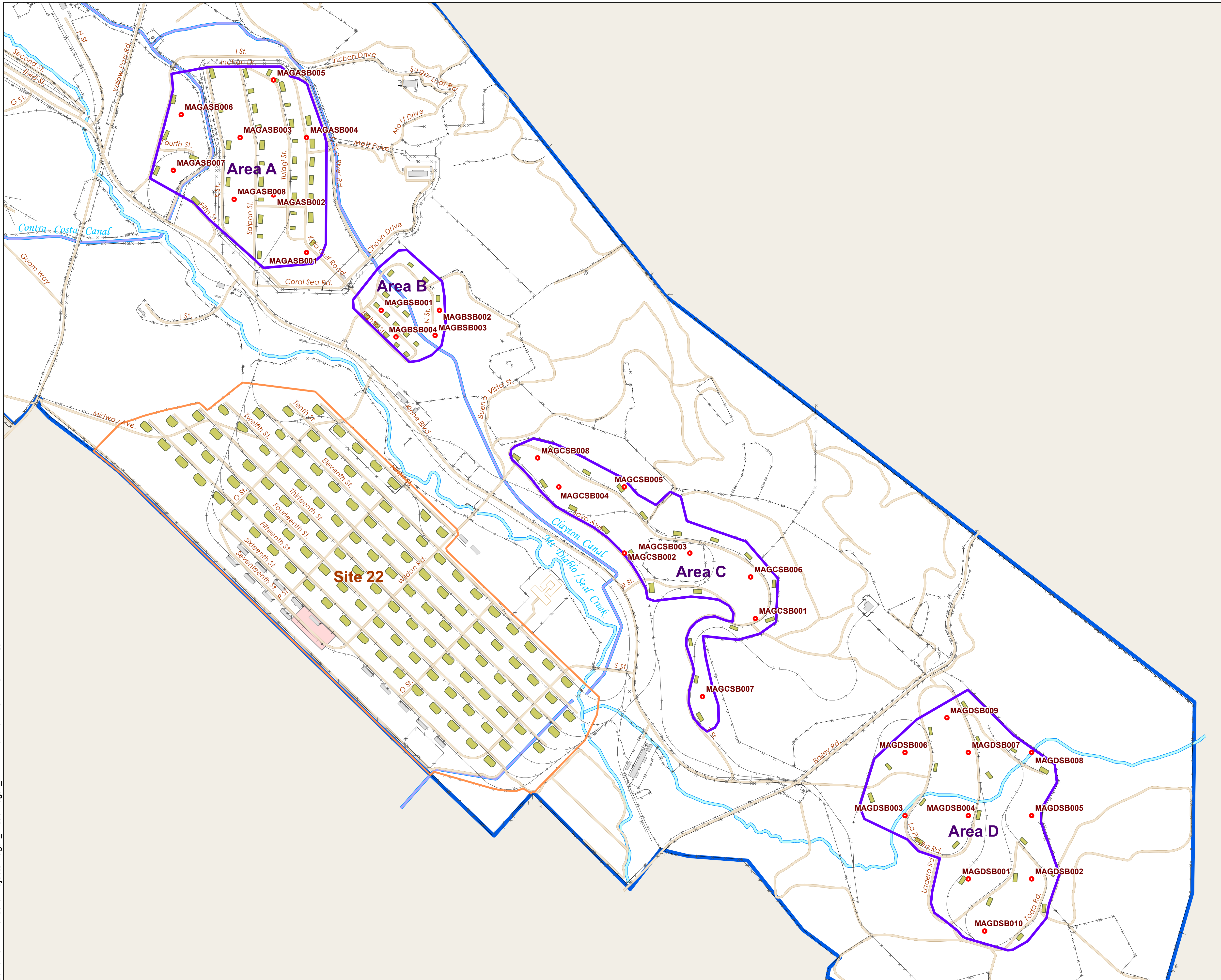
0 0.25 0.5 0.75 1
Miles

Tetra Tech EM Inc.

DETACHMENT CONCORD

FIGURE 2
SITE 22 AND
INLAND AREA MAGAZINES

2005-08-08 V:\Concord\Projects\RI_Site 22\Location_Map.mxd TtEMI-SF Aleksandr Zhuk



- Proposed Surface Soil Sampling Location in the Magazine Areas
- Ammunition Magazine
- Magazine Area
- Site 22 Boundary
- Detachment Concord Boundary
- Building 7SH5 Study Area
- Building
- Street
- Railroad
- Fenceline

N

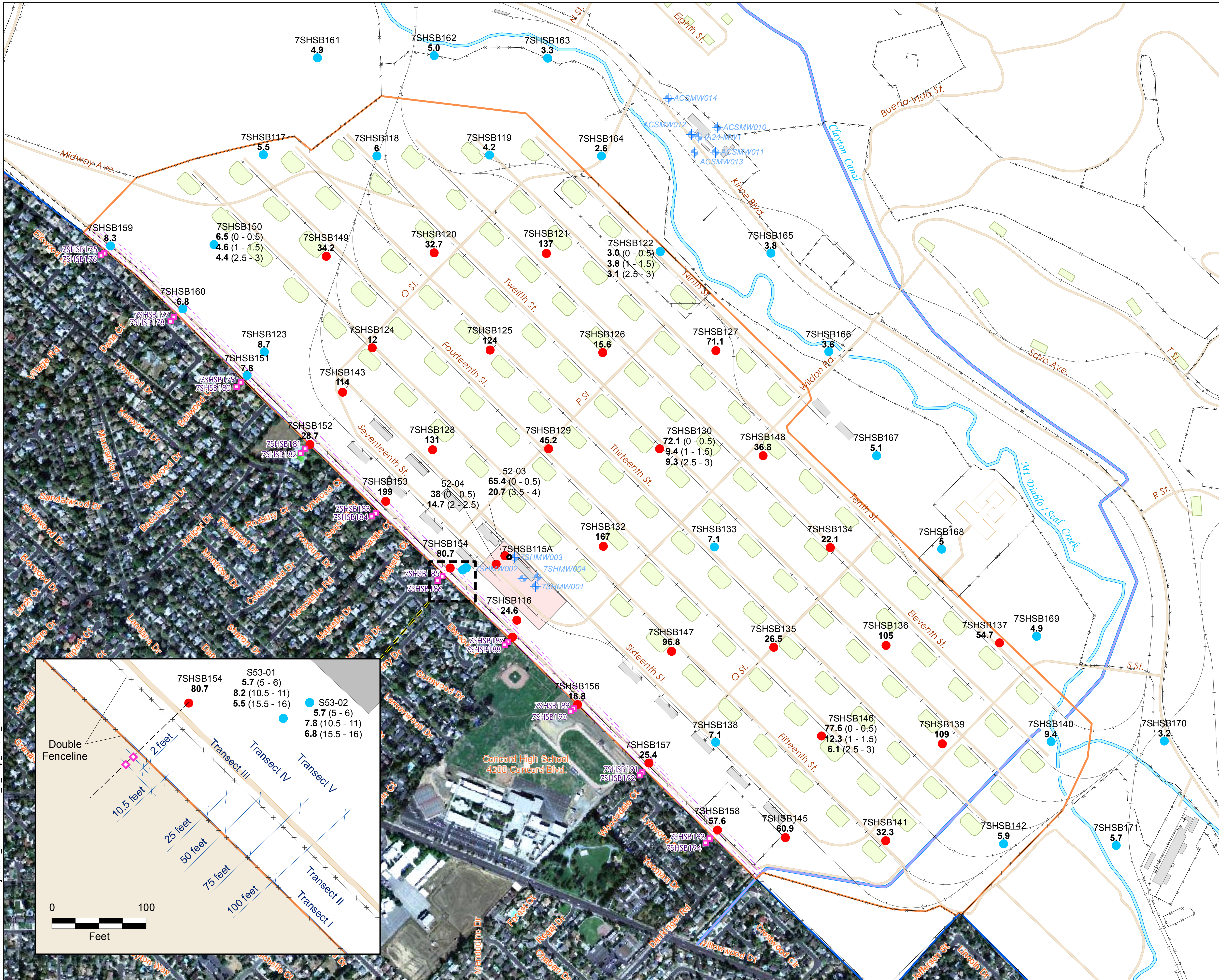
1,500 0 1,500
Feet

Tetra Tech EM Inc.

DETACHMENT CONCORD

FIGURE 3
PROPOSED SURFACE SOIL SAMPLING LOCATIONS IN THE MAGAZINE AREAS

2005-10-13 V:\Concord\Projects\Magaz_Areas\Magaz_ABCD.mxd TtEMI-SF Kevin Ernst



Suisun Bay

NAVAL WEAPONS STATION SEAL BEACH DETACHMENT

- Monitoring Well Location
- Direct Push Boring Location for Grab Groundwater

Proposed Surface Soil Sampling Location
- In Off-site Area

Concentration of Arsenic in Surface Soil
- ≤ 10 mg/kg
- > 10 mg/kg
- Site 22 Boundary
- Building 7SH5 Study Area
- Ammunition Magazine
- Building
- Transect
- Fenceline
- Detachment Concord Boundary
- Railroad
- Street

Notes:
1. All samples are surface soil samples (0 to 0.5 feet below ground surface) except those whose depths are show in parenthesis.
2. The ambient concentration for arsenic in the Inland Area at Site 22 is 10 mg/kg.
3. Tissue samples (grass) were collected at sample locations 7SHSB116, 7SHSB121, and 7SHSB123. Arsenic was not detected in any of these samples.
4. mg/kg = milligrams per kilogram.

N

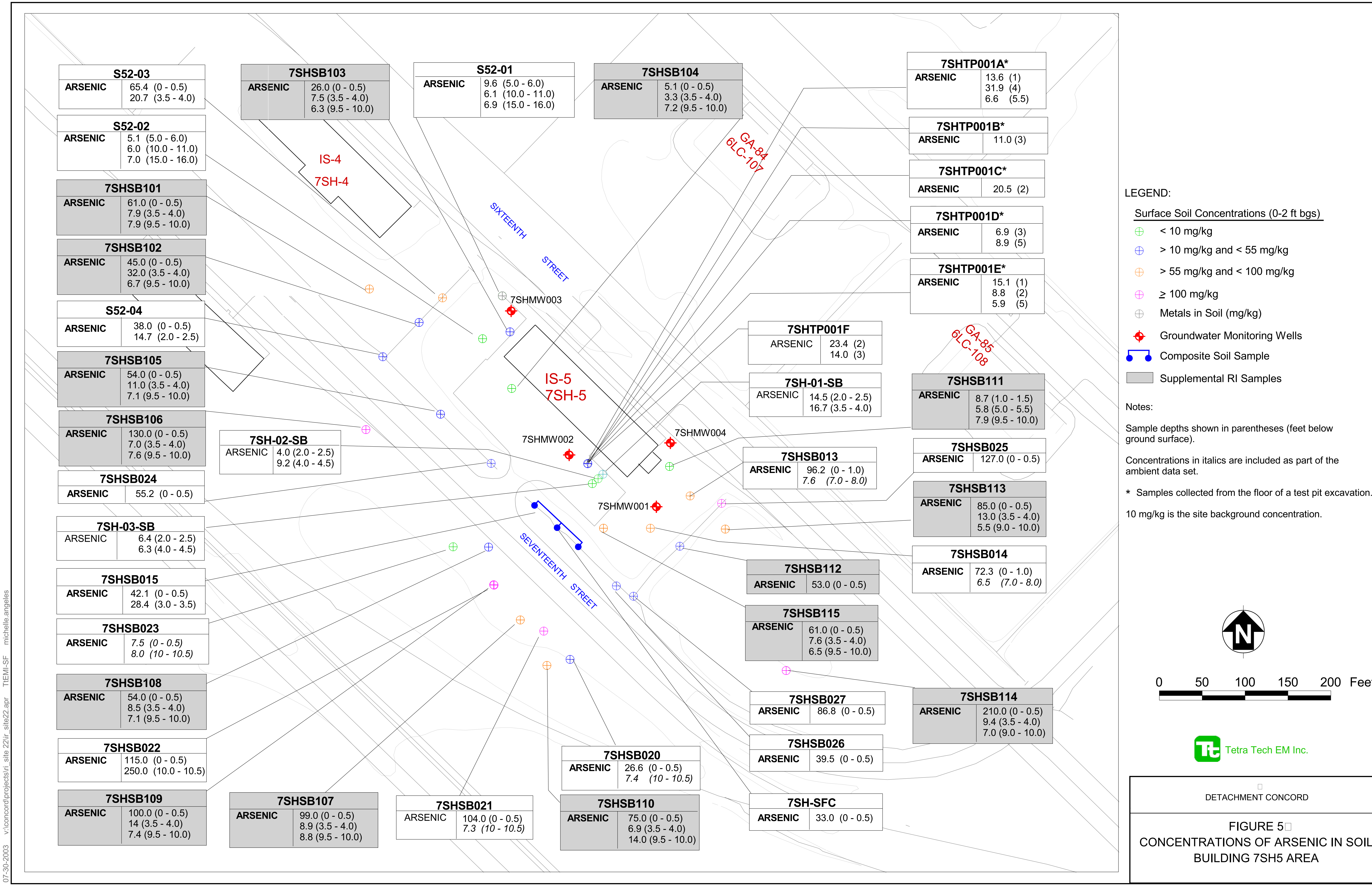
750 0 750
Feet

Tetra Tech EM Inc.

DETACHMENT CONCORD

FIGURE 4
CONCENTRATIONS OF ARSENIC IN SURFACE SOIL AT SITE 22 AND PROPOSED SURFACE SOIL SAMPLING LOCATIONS IN OFF-SITE AREA

2005-08-08 V:\Concord\Projects\RI_Site 22\Arsenic_&_Prop_Offsite_SB.mxd TtEMI-SF Aleksandr Zhuk



DETACHMENT CONCORD

FIGURE 5
CONCENTRATIONS OF ARSENIC IN SOIL
BUILDING 7SH5 AREA

The four other Inland Area magazine areas, referred to as Magazines A, B, C, and D for this study, are shown on Figure 2. These magazines, like the Site 22 magazine area, were constructed in the mid-1940s on agricultural land to support wartime activities and were used until 2001 to store ammunition and explosives. The combined acreage of Magazines A through D is approximately 458 acres. Magazines A through D were not identified for further investigation during the basewide initial assessment study (Ecology and Environment 1983). Because the site use history for Magazines A through D is similar to Site 22, these magazines were identified for assessment of arsenic in surface soils.

The main purpose of this investigation will be to evaluate the impact of the historical application of arsenic-containing herbicides at Site 22. Additional data obtained during the investigation will be used to:

(1) Evaluate whether the suspected historical application of an arsenic-containing herbicide at the Site 22 magazines has affected the off-site area southwest of the base's perimeter fence line and, if so, whether concentrations pose a risk to human health.

(2) Evaluate whether arsenic-contaminated soil might have been transported off site to Mount Diablo/Seal Creek via surface water flow.

(3) Evaluate whether arsenic-contaminated sediment is present in low-lying areas in the western portion of the Site 22 Magazine Area.

(4) Evaluate whether arsenic-contaminated sediment is present in the southeastern portion of Site 22 Magazine Area, within the abandoned Clayton Canal.

(5) Assess whether arsenic-containing herbicides were used to control vegetation in the other Inland Area magazines (Magazines A through D).

In accordance with the June 9, 2005, Draft Site Management Plan Amendment for the Detachment Concord Installation Restoration Program, the Navy will submit a draft remedial investigation (RI) report for Site 22 by February 3, 2006. The RI will incorporate existing site data and new data from the off-site sampling investigation and the investigation of Mount Diablo and Seal Creek proposed in this SAP. Data from sampling at Inland Area Magazines A through D will be summarized in a separate package that will include sampling results and figures.

Tetra Tech prepared this SAP, consisting of a field sampling plan (FSP) and a quality assurance project plan (QAPP), in an integrated format to guide the field, laboratory, and data reporting efforts associated with this project.

Table 1 follows the approval page at the beginning of this SAP. The table demonstrates how this SAP addresses all the elements of a QAPP currently required by the U.S. Environmental Protection Agency (EPA) QA/R-5 guidance document (EPA 2001).

Tables and figures follow their first reference in the text in this document. Appendix A contains photographs of Site 22; Appendix B includes the *in vitro* method for determination of lead bioaccessibility (standard operating procedure for stomach phase extraction); Appendix C lists method precision and accuracy goals; Appendix D contains Tetra Tech's field forms; Appendix E lists project-required reporting limits (PRRL); Appendix F lists laboratories that Tetra Tech has contracted to analyze samples collected under Navy contracts; and Appendix G presents the combined responses to regulatory agency and public comments on the Draft and Draft Final SAP. Some of the responses to comments on the draft that were included in the Draft Final SAP have been revised to reflect agency and Navy discussions about sampling in Mount Diablo/Seal Creek and Site 22. Revisions are presented in strikeout, while additional text has been added in italics.

1.1 PROBLEM DEFINITION AND BACKGROUND

This section describes the following:

- Purpose of the Investigation (Section 1.1.1)
- Problem to be Solved (Section 1.1.2)
- Facility Background (Section 1.1.3)
- Physical Setting and Site Description (Section 1.1.4)
- Summary of Previous Investigations (Section 1.1.5)
- Principal Decision-Makers (Section 1.1.6)
- Technical or Regulatory Standards (Section 1.1.7)

1.1.1 Purpose of the Investigation

The purpose of the investigation is to evaluate the impact of the application of arsenic-containing herbicides at Site 22 on the adjacent off-site properties to the southwest and to assess whether widespread application of arsenic-containing herbicides in other Inland Area magazines has occurred. Concentrations of arsenic in Mount Diablo/Seal Creek sediment will be evaluated to address concerns that arsenic-contaminated soil from the Site 22 Magazine Area might have migrated off site to Mount Diablo/Seal Creek via surface water flow. Arsenic concentrations in soil in low-lying drainage areas in the western portion of Site 22 Magazine Area will be investigated as will concentrations of arsenic in soil in the portion of the abandoned Clayton Canal located in the southeastern area of the Site 22 Magazine Area.

1.1.2 Problem to be Solved

Initially, the investigation area at Site 22 consisted of Building 7SH5, a former missile and wing repair facility. However, the area was later expanded to include the adjacent 250 magazines after concentrations of arsenic were repeatedly detected in surface soil at concentrations above the ambient value of 10 mg/kg in open grasslands near the building. In addition, no known source of arsenic at Building 7SH5 was identified.

As discussed in Section 1.0, a newspaper article from the *Contra Costa Gazette* dated May 10, 1947, was located during the Navy's review of other potential sources of arsenic in the area. This article reported that the Navy had sprayed an arsenic-containing solution (referred to in the article as "sodium arsenite") on "undergrowth on top and within 50 feet of munitions dumps in the HE No. 3 area to kill tall grass" that represented a fire hazard (*Contra Costa Gazette* 1947). Although the Site 22 magazines were not identified in the article as an area that was sprayed, the Navy hypothesized that arsenic-containing solution could have been sprayed in the open grassland near Building 7SH5 for weed control to protect the magazines from fire. Inorganic arsenate was a commonly applied pesticide in the pre-World War II era (University of Iowa College of Public Health 2003) and may have also been used on the orchards at the site and adjacent off-site properties before the Navy owned the land.

It was hypothesized that the arsenic contamination would be widespread if the area was sprayed to control vegetation. The Navy's hypothesis was supported by the results of the June/July 2004 sampling of the Site 22 Magazine Area. Uniformly elevated concentrations of arsenic were detected in surface samples collected within and among the magazines (above ambient concentrations), while concentrations of arsenic outside the study boundary and at depth were significantly lower (consistent with ambient concentrations) (Figures 4 and 5). The concentrations of arsenic detected and the spatial relationship of the contamination suggests a pattern consistent with surface application of herbicides. As part of the July 2004 investigation, the Navy also submitted samples for analysis for other pesticides and herbicides, which may have been used over the subsequent decades. Concentrations of these pesticides and herbicides were generally below residential human health screening criteria.

Data are needed to:

- Evaluate whether the application of arsenic-containing herbicides has affected the off-site properties southwest of the boundary of Site 22. Two chain-linked fences topped with barbed wire separate the Navy property from residential homes, the Concord High School, and the Gehringer Park Recreation Club located southwest of Site 22. Arsenic was detected in surface soil samples collected along the fence line at concentrations ranging between 6.8 mg/kg (sample 7SHSB160, collected approximately 75 feet from outer fence) and 199 mg/kg (sample 7SHSB153, collected approximately 100 feet from outer fence) (Figure 4).

- Assess concentrations of arsenic in Mount Diablo/Seal Creek sediments. Arsenic was not detected at elevated levels in surface soil samples collected between the Site 22 Magazine Area and Mount Diablo/Seal Creek (Figure 4). The regulatory agencies have expressed concern, however, that arsenic-contaminated soil might have migrated to Mount Diablo/Seal Creek via surface water flow. The Navy has agreed to expand this assessment over what was presented in the Draft Final SAP.

- Assess concentrations of arsenic in the western portion of the Site 22 Magazine Area (referred to as Drainage Areas A and B on Figure 6A) and the southeastern portion of the Site 22 Magazine Area within the abandoned Clayton Canal (Figure 4). The regulatory agencies have expressed concern that arsenic-contaminated soil might have migrated to these areas. Concentrations of arsenic in samples collected previously from Drainage Areas A and B, a low-lying area of the site, were below ambient levels. The abandoned Clayton Canal was not previously sampled. The Navy has agreed to this assessment.

- Assess whether the other Inland Area magazines (referred to as Magazines A, B, C, and D for this study) have been contaminated by the application of arsenic-containing herbicides, similar to the Site 22 Magazine Area (Figure 3).

1.1.3 Facility Background

Detachment Concord is the major naval munitions transshipment facility on the West Coast. Detachment Concord is located in the north-central portion of Contra Costa County, California, 30 miles northeast of San Francisco (Figure 1). The facility, which encompasses 13,000 acres, is bounded to the north by Suisun Bay, to the east by Los Medanos Hills and the City of Pittsburg, and to the south and west by the City of Concord. Currently, the facility is made up of two main separate land holdings: the Tidal Area (which includes islands in Suisun Bay), and the Inland Area. Although the base remains active, it is operating at reduced capacity.

In December 1942, the Navy commissioned the ordnance-shipping depot at Naval Magazine, Port Chicago, now known as the Tidal Area of Detachment Concord. When munitions that passed through the Port Chicago waterfront began to exceed the capacity of the facility, the Navy acquired a 5,143-acre parcel of land in Diablo Creek Valley. This parcel became the Inland Area of Detachment Concord.

The Inland Area encompasses 6,200 acres. A Navy-owned road and rail line link the Inland Area to the Tidal Area. The Inland Area lies between Los Medanos Hills and the City of Concord and is crossed by three public roads: State Route 4, Willow Pass Road, and Bailey Road.

Current operations at Detachment Concord are associated primarily with routine ammunition transshipment and storage. At present, the facility's current active tenant, the U.S. Department of the Army, limits these activities mostly to the Tidal Area. Although the Army controls daily activities at the site, the Navy retains responsibility for environmental restoration at the facility. Since 1999, the Inland Area has been on reduced operational status and is mostly inactive (mothballed); there are no immediate plans to resume active operations. Former operations in the Inland Area included receiving both containerized and bulk munitions for inspection and classification. Munitions were held until they could be transported and unloaded. Five magazine groups for ammunition storage were used within the Inland Area. The Inland Area also housed several production support facilities for weapons, as well as vehicle maintenance facilities. The northwestern corner of the Inland Area included an administrative complex, the public works department, and housing for personnel to support the munitions operations. The 162-acre public golf course (80 acres of which are owned by the

City of Concord) remains active. A Weapons Quality Engineering Center was located between State Route 4 and Willow Pass Road, and an abandoned airfield south of State Route 4 was used to train forklift operators. About 1,000 acres of pastureland in the Inland Area currently are leased for cattle grazing. No current plans have been made for any change in land use or ownership of the Inland Area.

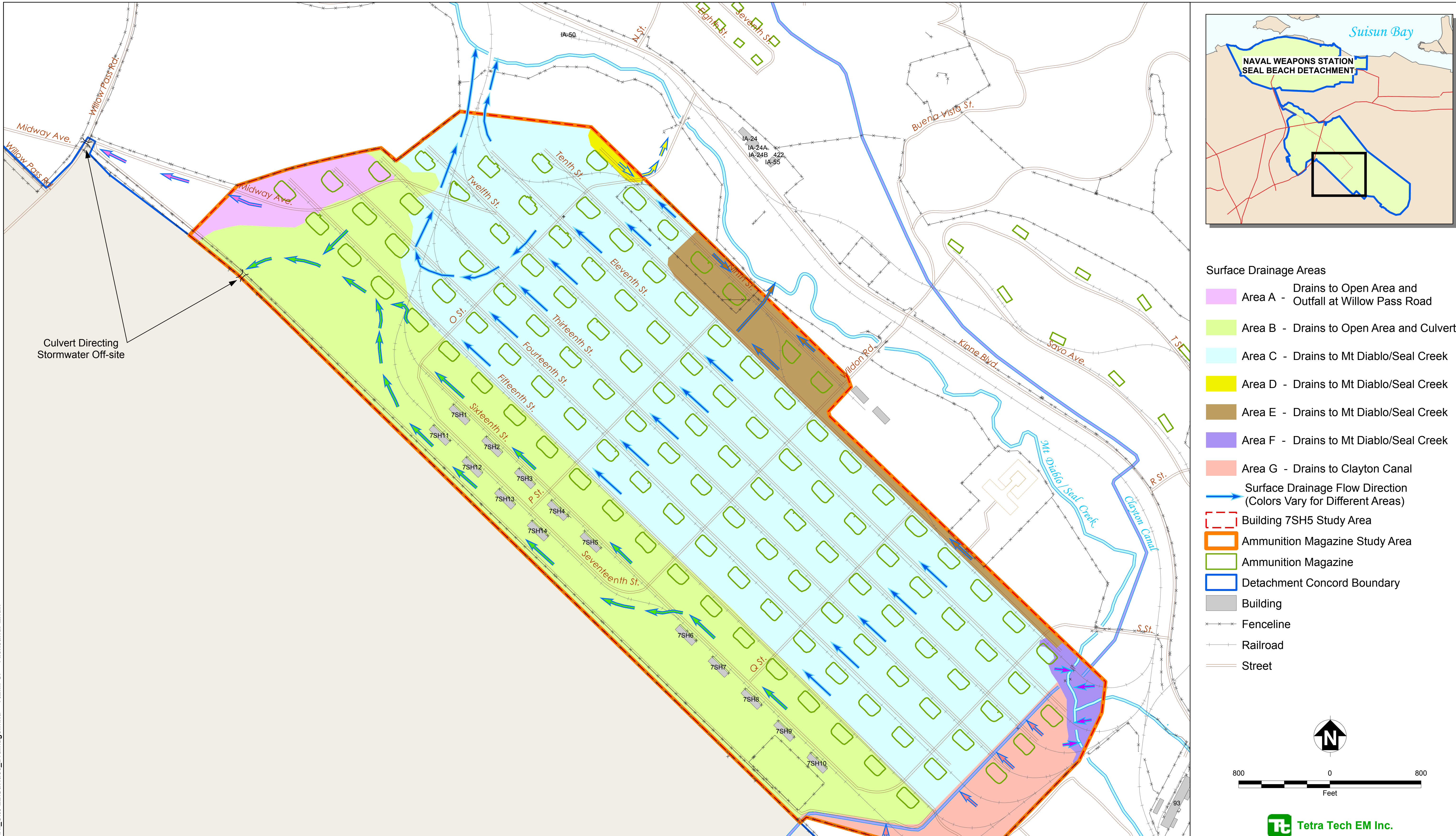
1.1.4 Physical Setting, Site Description, and Site History

Site 22 currently consists of 531 acres and includes 13 buildings and 250 munitions storage magazines connected by a series of parallel roads and railroad spurs and surrounding open grassland (Figures 3 and 4).

A portion of Mount Diablo/Seal Creek and Clayton Canal traverses the eastern and southeastern portion of Site 22. The area is relatively flat. The direction of surface drainage flow at Site 22 is shown on Figure 6A. Some overland flow is toward Mount Diablo/Seal Creek, through a network of drainage ditches on the site. Flow in Mount Diablo/Seal Creek is intermittent, occurring primarily during the winter rainy season. Historical records show that some degree of flooding occurs during normal precipitation years along portions of the creek near the Tidal Area; however, the section of the creek that runs through the Inland Area is not a source of severe overbank flooding because the channel is deeply incised. The Clayton Canal, which is managed by the Contra Costa Water District, was abandoned in 1985. The canal, which is approximately 4.85 miles in length, has been filled in or overgrown with vegetation (see Appendix A photographs). According to Jeff Quimby of the Contra Costa Water District (CCWD), the canal was used to deliver water from CCWD's main canal to irrigation customers in eastern concord. Mr. Quimby indicated that water in the Clayton Canal at the station flowed to the southeast. Since the Clayton Canal no longer contains water, it is not habitat for fish.

The direction of surface drainage flow at Inland Area Magazines A through D are shown on Figure 6B. In this area, the Clayton Canal crossed within or adjacent to the magazines (Figure 7). The Contra Costa Canal, which is active, is located to the southwest of Magazine Area A.

According to the 1995 San Francisco Basin Plan, the site is located within the Clayton Valley Watershed (http://www.waterboards.ca.gov/sanfranciscobay/basinplan.htm). The plan indicates that the existing beneficial use of groundwater at the site is for municipal and domestic water supply. Other potential groundwater beneficial uses identified include industrial process water supply, industrial service water supply, agricultural water supply, and freshwater replenishment supply to surface water.

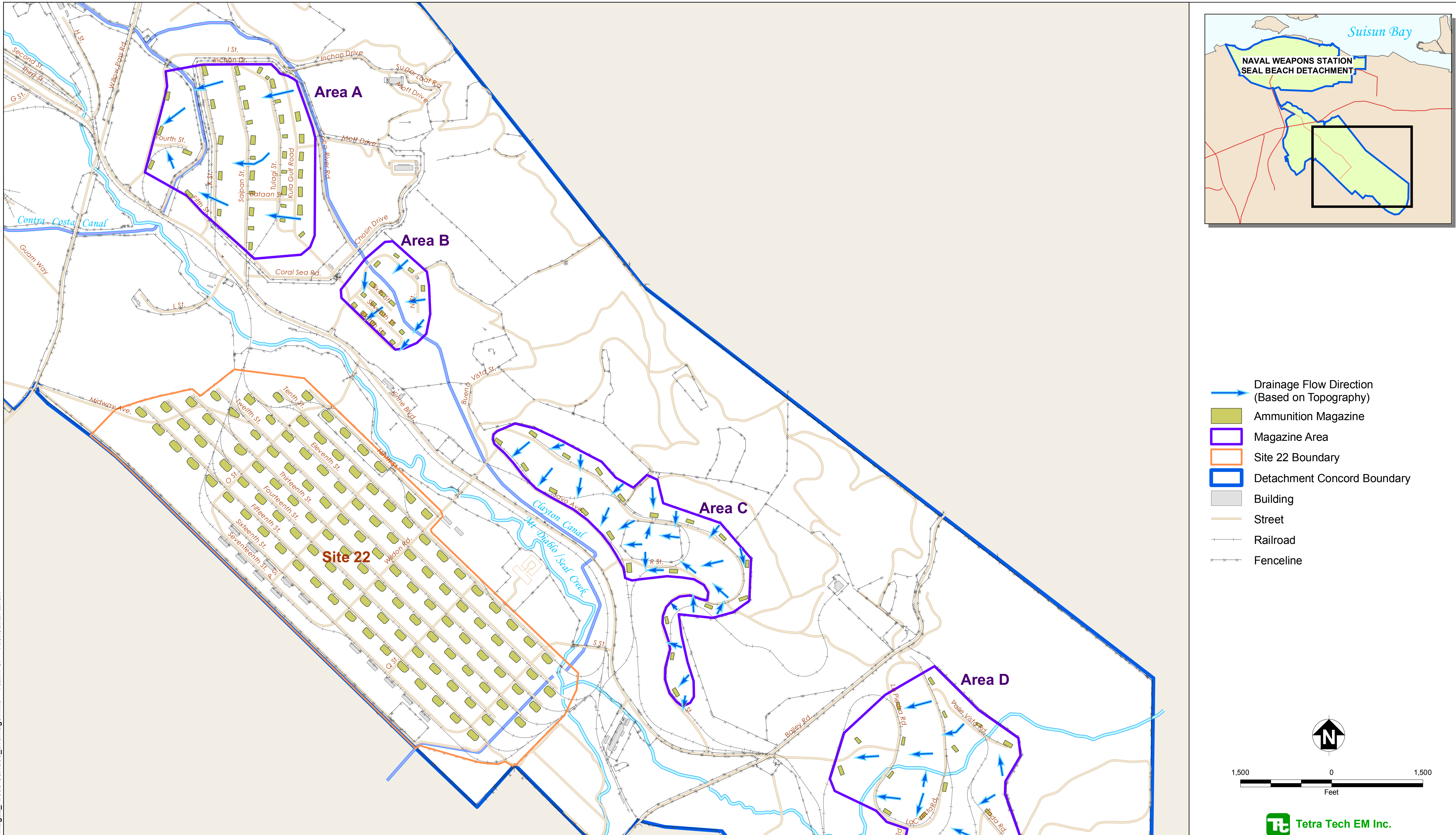


Tetra Tech EM Inc.

DETACHMENT CONCORD

FIGURE 6A
SURFACE DRAINAGE MAP

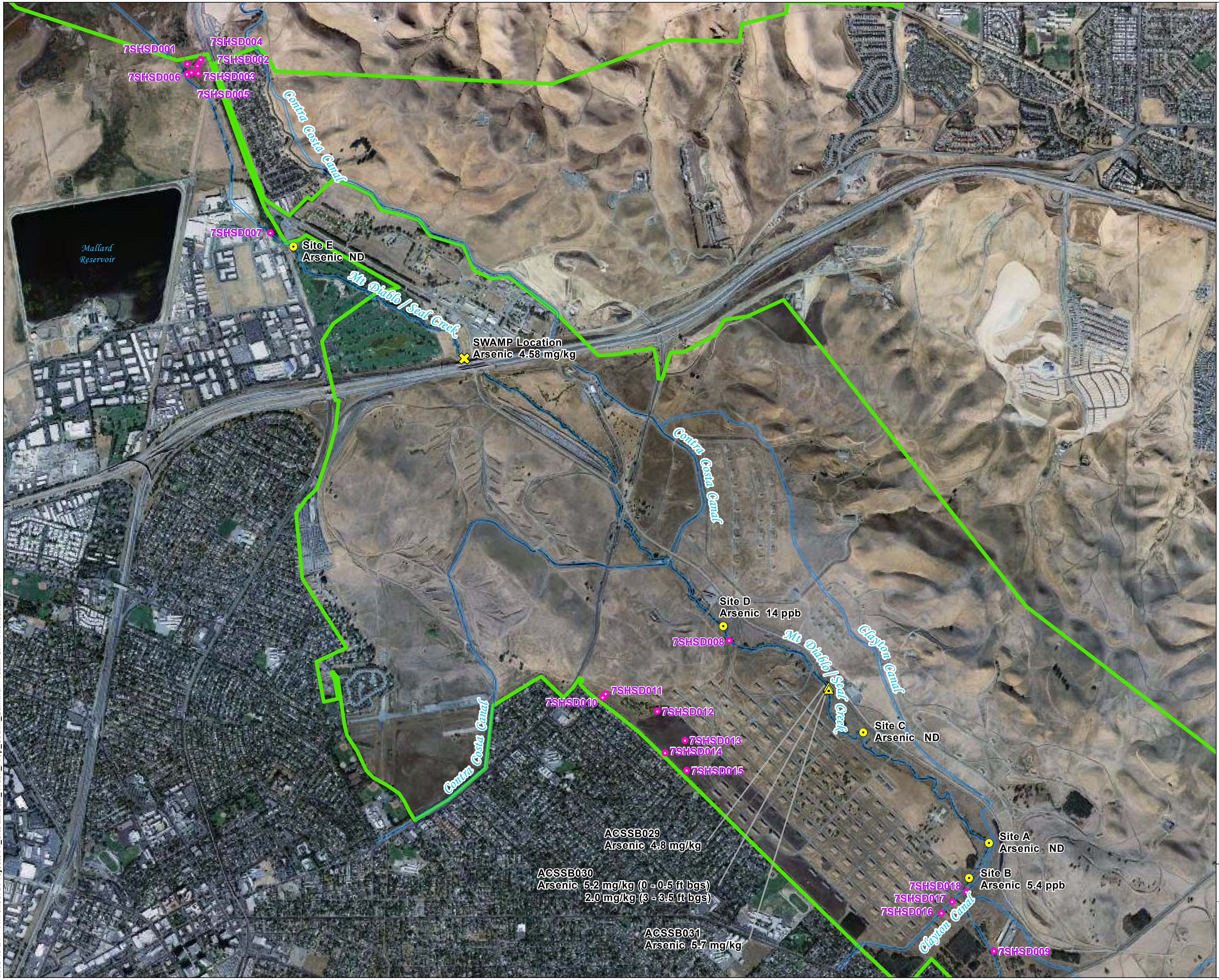
2005-08-05 V:\Concord\Projects\RI_Site 22\Surface_Drainage.mxd TtEMI-SF Aleksandr Zhuk

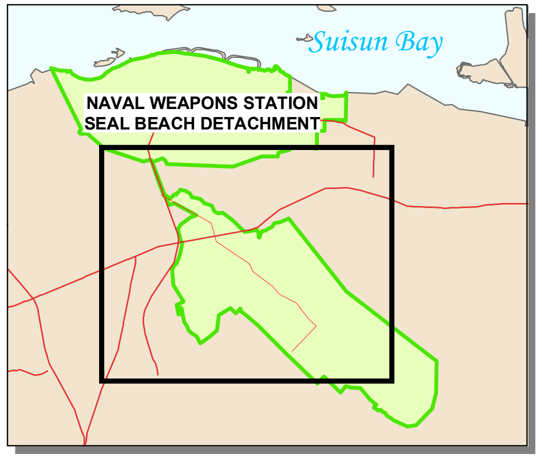


DETACHMENT CONCORD

FIGURE 6B
SURFACE DRAINAGE MAP
INLAND AREA MAGAZINES
A THROUGH D

2005-08-09 V:\Concord\Projects\Magaz_Areas\Surface_Drainage.mxd TtEMI-SF Aleksandr Zhuk





- Proposed Sediment Sampling Location
- Site 17 Surface Sediment Sampling Location
- Waterboard Water Quality Surface Sampling Result
- Sediment Sampling Location Surface Water Ambient Monitoring Program (SWAMP)
- Detachment Concord Boundary

Notes:

1. Proposed location 7SHSD001 will be moved as far upstream on Navy property as possible.
2. Sediment samples are approximate and will be surveyed with GPS in the field based on the original markers placed during the site visit on September 23, 2005.
3. Three discrete samples each will be collected at locations 7SHSD007 through 7SHSD009. One discrete sample will be collected at all other locations.
4. Natural recommended water quality criteria for arsenic in freshwater (http://www.epa.gov/waterscience/criteria). Criterion Maximum Concentration 340 µg/l, Criterion Continiuos Concentration 340 µg/l.
5. Image date February 27, 2004. Courtesy of the U.S. Geological Survey.
6. ft bgs Feet below ground surface
7. mk/kg Milligrams per kilogram
8. µg/l Micrograms per liter
9. ND Not detected.
10. ppb Parts per billion

N

2,000 0 2,000

Feet

Tetra Tech EM Inc.

DETACHMENT CONCORD

FIGURE 7
PROPOSED SEDIMENT SAMPLING LOCATIONS IN MOUNT DIABLO / SEAL CREEK AND SITE 22

2005-10-24 V:\Concord\Projects\RI_Site 22\Seal_Creek_Prop_Sedim_SL.mxd TtEMI-SF Aleksandr Zhuk

The beneficial uses identified for Mount Diablo/Seal Creek include municipal and domestic water supply, agricultural water supply, industrial process water supply, wildlife habitat, cold and warm freshwater habitat.

The primary habitat at Site 22 and Inland Area Magazines A through D is annual grasslands, consisting mainly of non-native grasses and forbs, with some riparian habitat nearby at Seal Creek. Species observed in these habitats include the loggerhead shrike (*Lanius ludovicianus*), the federally designated candidate California tiger salamander (*Ambystoma tigrinum californiense*) and the red-legged frog (*Rana aurora draytonii*). Additionally, Tule elk (*Cervus elaphus nannodes*) range throughout the Inland Area of Detachment Concord, their range including the entirety of Site 22. The herd is managed as a reserve by the California Department of Fish and Game and Detachment. There are no fishery resources in the Inland Area.

Other species associated with the annual grassland habitat at Site 22 include black-tailed jackrabbit (*Lepus californicus*), coyote, striped skunk (*Mephitis* spp.), opossum (*Didelphis marsupialis*), bobcat (*Felis rufus*), Columbian black-tailed deer (*Odoocoileus hemionus columbianus*), gray fox (*Canis cinereoargenteus*), California vole (*Microtus californicus*), and a number of rodents, such as ground squirrel, deer mouse (*Peromyscus californicus*), and the western harvest mouse (*Reithrodontomys megalotis*). Reptiles and amphibians associated with this habitat type include the western whiptail (*Cnemidophorus tigris*) and the Pacific gopher snake (*Pituophis melanoleucus catemofer*). Common bird species include western meadowlark (*Sturnella neglecta*), red-tailed hawk (*Buteo jamaicensis*), savannah sparrow (*Passerculus sandwichensis*), barn swallow, and the black phoebe (Sayorinis nigricans).

The mixed riparian habitat of Seal Creek include numerous bird species such as the dark-eyed junco (*Junco hyemalis*), American goldfinch (*Carduelis tristis*), mourning dove, western scrub-jay (*Aphelocoma coerulenscens*), barn swallow, yellow-rumped warbler (*Dendroica coronata*), ruby-crowned kinglet (*Regulus calendula*), and Anna’s hummingbird (*Calypte anna*). Mammals observed at Seal Creek include the California ground squirrel, California vole, raccoon, striped skunk, Tule elk, and the opossum.

Concord High School, the Gehringer Park Recreation Club, and a residential area border the site to the southwest. The Inland Area borders the site to the northwest, north, east, and southeast. Two chain-linked fences topped with barbed wire separate the off-site properties from the Site 22 Magazine Area. The first fence runs along the property lines of the residences, high school, and Gehringer Park Recreation Club. The second fence is on Detachment Concord property and is 50 feet from, and parallel to, the first fence. Current photographs of the site are shown in Appendix A.

The four other inland Magazine Areas are referred to as Magazines A, B, C, and D for the purposes of this study. They are shown on Figure 2. The number of magazines in each area and the areal extent are listed below:

- Magazine A – 39 magazines; 154 acres
- Magazine B – 17 magazines; 39 acres
- Magazine C – 20 magazines; 124 acres
- Magazine D – 20 magazines; 185 acres

The magazines in Areas A through D and at Site 22 were constructed in the mid-1940s on agricultural land to support wartime activities. The Navy stored ammunition and explosives in the magazines from the mid-1940s to 2001. Table 2 lists the explosive fillers associated with ordnance and explosive items that may have been stored in the magazines (Tetra Tech 2004a). Information on the specific types of explosives and ordnance stored in the magazine study area and dates of storage is classified.

To certify closure, the Navy reviewed the safety inspection and clearance certification closure reports for each of the magazines and interviewed personnel familiar with operations in each magazine area. According to these reports, which were all reviewed by Margaret Wallerstein, Installation Restoration (IR) manager for Seal Beach, all of the magazines were "free of any visible staining that might be an indication of environmental contamination," and "free of any visible explosive residues."

The IR manager for Detachment Concord interviewed Paul Pudenz, a former Navy worker in the area, and Richard Pieper, director of Public Works at the facility. These interviews indicated that the magazines were used strictly for storage. Both interviewees had no knowledge of any spill or release in the magazine areas.

The procedure for maintenance and operations of the magazines is documented from the 1970s until the last date of operations. Prior to 1970, no records exist to describe standard maintenance and operations of the magazine area. According to Mr. Pieper, the magazines were never flushed or steam cleaned. Instead, any residue observed in the magazines was contained in accordance with current standard operating procedures.

The Navy manages resources in the Inland Area in accordance with the Integrated Natural Resources Management Plan (Tetra Tech 2002). The Navy currently leases the area that encompasses the Inland Area magazines for cattle grazing from September to March (Navy 2004). Ranchers, security personnel, fire protection specialists, and investigators under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) infrequently visit the site.

TABLE 2: PERCENTAGE OF MATERIAL FILLER IN EXPLOSIVES AND ORDNANCE THAT MAY HAVE BEEN STORED IN THE INLAND AREA MAGAZINES

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Filler	Use	TNT	RDX	HMX	DNT	Potassium Nitrate
Composition A	Projectile fillers, boosters, grenades, and shaped chargers		91-98%			
Composition B	High energy projectiles, grenades, shaped charges, and fragmentation charges	40%				
Cyclotol	High energy projectiles, grenades, shaped charges, and bursting charges	25%	75%			
HBX	High energy projectiles and projectile fillers	29%		49%		
Black Powder	Igniter powder and time fuzes					40-60%
Octols	High energy projectiles, shaped charges, and bursting charges	25-35%			70-75%	

Notes:

DNT Dinitrotoluene
HBX High Brissance Seraphim
HMX Cyclotetramethylene-tetranitramine (the abbreviation is for "high melting explosive")
RDX Cyclotrimethylene trinitramine
TNT 2,4,6-Trinitrotoluene

Source:

Navy Explosive Ordnance Bulletin, Army Technical Memorandum, Air Force Training Technical Objective. 1993. "Explosive Ordnance Disposal Procedures, Description and Disposal for Conventional Explosives and Related Hazardous Materials." October 27. Revision 4.

1.1.5 Summary of Previous Investigations

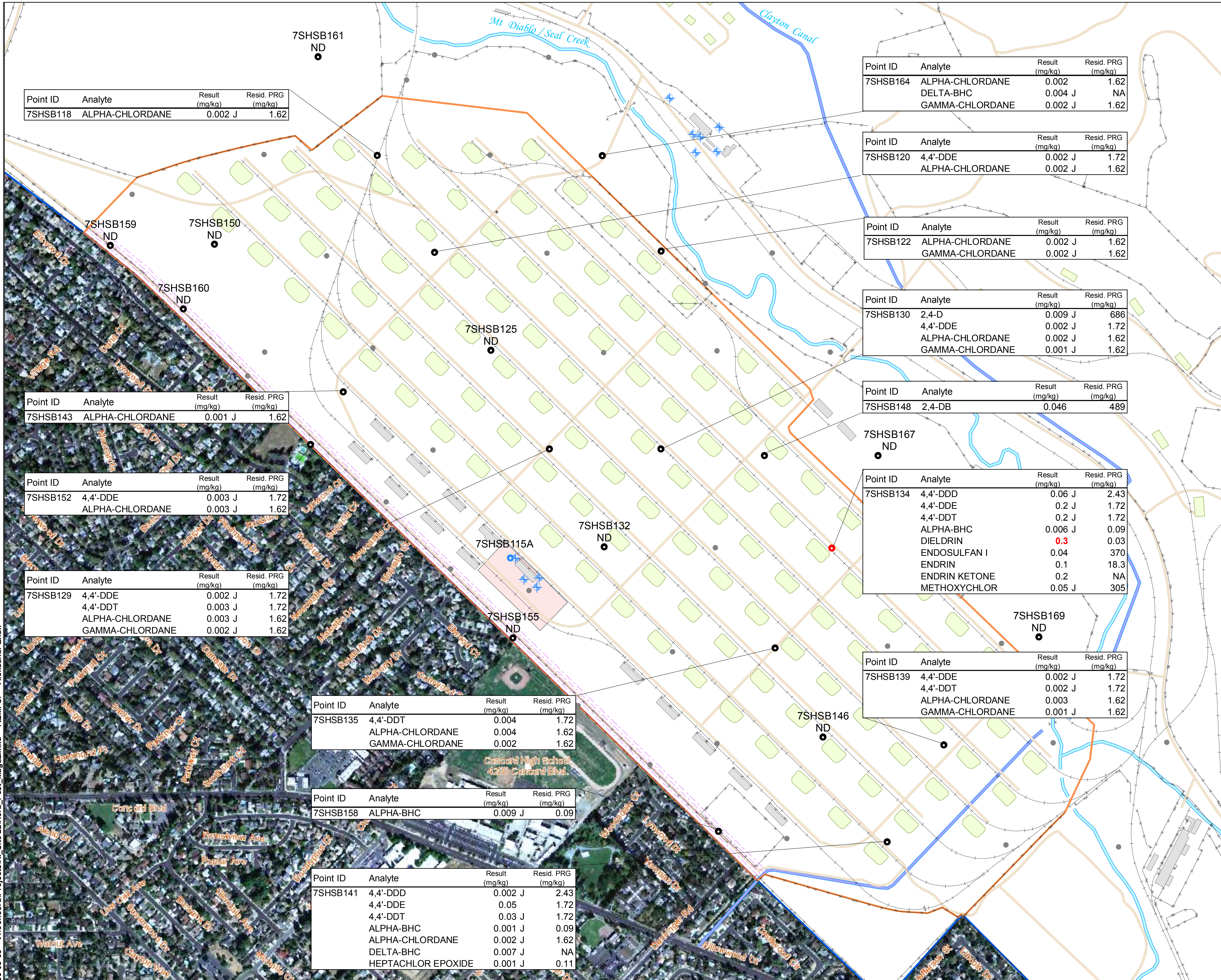
This section summarizes the previous investigations conducted at Site 22 or Mount Diablo/Seal Creek. As discussed in Section 1.1.2, the original focus of remedial investigation at Site 22 was Building 7SH5 based on its past use as a missile wing and fin repair facility. The Site 22 study area was later expanded in 2004 to include the 250 adjacent magazines formerly used for munitions storage.

No previous environmental investigations have been conducted at the other Inland Area magazines (Magazines Area A through Area D).

The following investigations were conducted at Site 22 or are related to the proposed sampling. Until 2004, most of the investigation at Site 22 focused on Building 7SH5 as a possible source of contamination.

- An initial assessment study (IAS) (E&E 1983)
- A site investigation (SI) (PRC Environmental Management, Inc. [PRC] 1993)
- An underground storage tank (UST) investigation (Harding Lawson Association [HLA] 1995)
- A Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) that included a solid waste management unit (SWMU) investigation (PRC 1997)
- A Phase I RI (Tetra Tech 1997) and a Phase II RI (Tetra Tech 1998a)
- Draft ROD (Tetra Tech 1998b)
- Supplemental Remedial Investigation Installation Restoration Site 22 (Tetra Tech 2003)
- Investigation of Arsenic in Soil at Site 22 (Tetra Tech 2004b); Final data to be published in RI report)
- Health Consultation (Agency for Toxic Substances and Disease Registry [ATSDR] 2005)

Because this investigation is concerned with arsenic contamination most likely caused by the application of arsenic-containing herbicides, the following summary of previous investigation will focus on metals, pesticides, and herbicides detected in soil and groundwater at Site 22. Concentrations of arsenic in surface soils from all previous Site 22 CERCLA investigations are presented on Figures 4 and 5. Concentrations of herbicides and pesticides in soil are shown on Figure 8. All detected analytes in groundwater at Site 22 also are shown on Figure 9.



Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB118	ALPHA-CHLORDANE	0.002 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB164	ALPHA-CHLORDANE	0.002	1.62
	DELTA-BHC	0.004 J	NA
	GAMMA-CHLORDANE	0.002 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB120	4,4'-DDE	0.002 J	1.72
	ALPHA-CHLORDANE	0.002 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB122	ALPHA-CHLORDANE	0.002 J	1.62
	GAMMA-CHLORDANE	0.002 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB130	2,4-D	0.009 J	686
	4,4'-DDE	0.002 J	1.72
	ALPHA-CHLORDANE	0.002 J	1.62
	GAMMA-CHLORDANE	0.001 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB148	2,4-DB	0.046	489

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB143	ALPHA-CHLORDANE	0.001 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB152	4,4'-DDE	0.003 J	1.72
	ALPHA-CHLORDANE	0.003 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB134	4,4'-DDD	0.06 J	2.43
	4,4'-DDE	0.2 J	1.72
	4,4'-DDT	0.2 J	1.72
	ALPHA-BHC	0.006 J	0.09
	DIELDRIN	0.3	0.03
	ENDOSULFAN I	0.04	370
	ENDRIN	0.1	18.3
	ENDRIN KETONE	0.2	NA
	METHOXYCHLOR	0.05 J	305

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB129	4,4'-DDE	0.002 J	1.72
	4,4'-DDT	0.003 J	1.72
	ALPHA-CHLORDANE	0.003 J	1.62
	GAMMA-CHLORDANE	0.002 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB139	4,4'-DDE	0.002 J	1.72
	4,4'-DDT	0.002 J	1.72
	ALPHA-CHLORDANE	0.003	1.62
	GAMMA-CHLORDANE	0.001 J	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB135	4,4'-DDT	0.004	1.72
	ALPHA-CHLORDANE	0.004	1.62
	GAMMA-CHLORDANE	0.002	1.62

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB158	ALPHA-BHC	0.009 J	0.09

Point ID	Analyte	Result (mg/kg)	Resid. PRG (mg/kg)
7SHSB141	4,4'-DDD	0.002 J	2.43
	4,4'-DDE	0.05	1.72
	4,4'-DDT	0.03 J	1.72
	ALPHA-BHC	0.001 J	0.09
	ALPHA-CHLORDANE	0.002 J	1.62
	DELTA-BHC	0.007 J	NA
	HEPTACHLOR EPOXIDE	0.001 J	0.11

- Monitoring Well Location
- Herbicides and Pesticides Sampling Location
- Herbicides and Pesticides Sampling Location with Results Exceeding Residential PRG (EPA 2002)
- Direct Push Boring Location for Grab Groundwater
- Other Sampling Location
- Detachment Concord Boundary
- Building 7SH5 Study Area
- Site 22 Boundary
- Ammunition Magazine
- Building
- Transect
- Fenceline
- Railroad
- Street

Notes:
1. All samples are surface soil samples (0 to 0.5 feet below ground surface).
2. ND - Location was sampled for pesticides and/or herbicides, but results were not detected.
3. J = Estimated result.
4. mg/kg = milligrams per kilogram.
5. NA = Not applicable.
6. ND = Not detected.
7. PRG = Preliminary remediation goal.
8. Resid. = Residential.

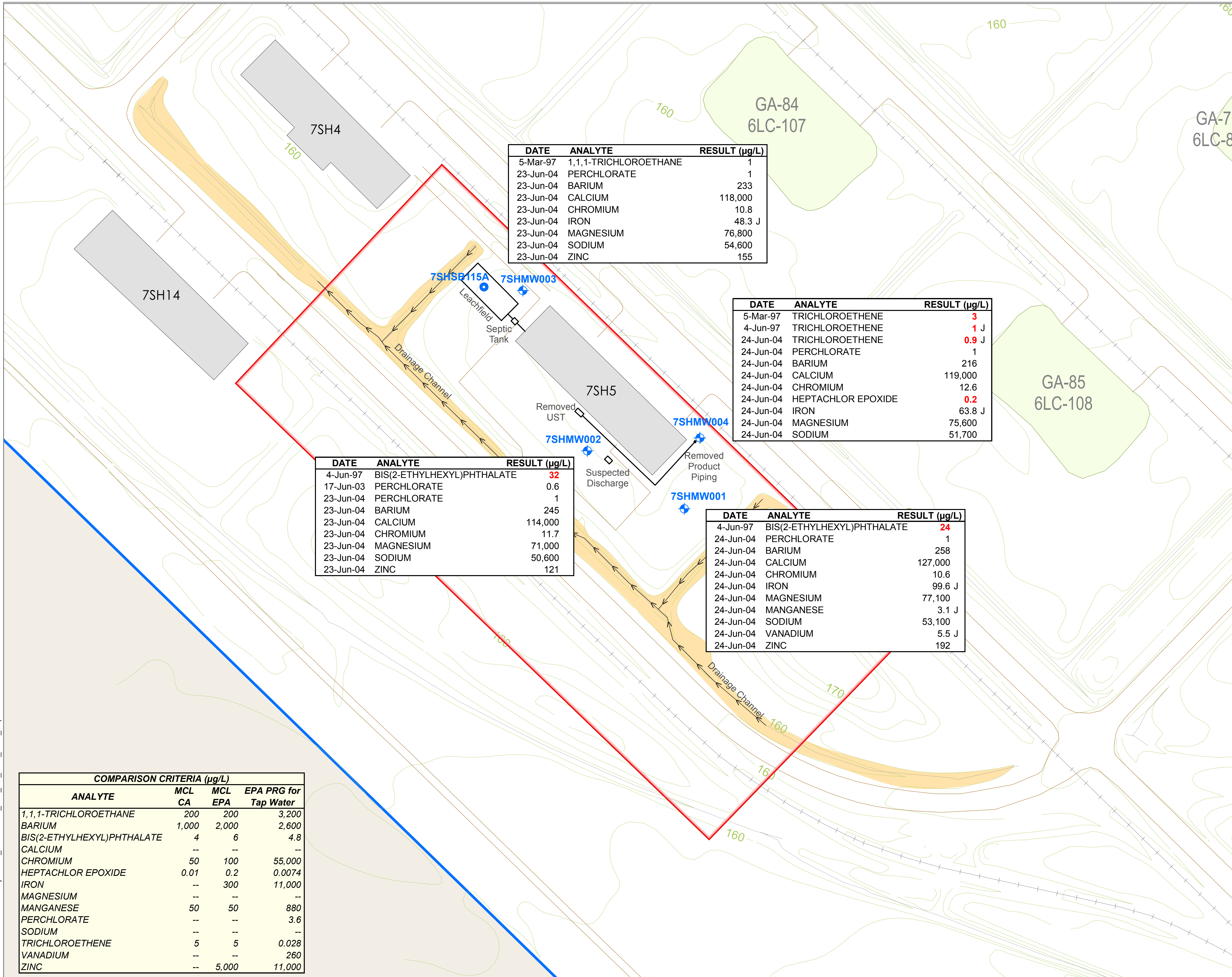
750 0 750
Feet

Tetra Tech EM Inc.

DETACHMENT CONCORD

FIGURE 8
CONCENTRATIONS OF HERBICIDES AND PESTICIDES IN SOIL IN THE MAGAZINE STUDY AREA

2005-08-08 V:\Concord\Projects\RI_Site 22\Herb_Pest_Magaz.mxd TtEMI-SF Aleksandr Zhuk



DATE	ANALYTE	RESULT (µg/L)
5-Mar-97	1,1,1-TRICHLOROETHANE	1
23-Jun-04	PERCHLORATE	1
23-Jun-04	BARIUM	233
23-Jun-04	CALCIUM	118,000
23-Jun-04	CHROMIUM	10.8
23-Jun-04	IRON	48.3 J
23-Jun-04	MAGNESIUM	76,800
23-Jun-04	SODIUM	54,600
23-Jun-04	ZINC	155

DATE	ANALYTE	RESULT (µg/L)
5-Mar-97	TRICHLOROETHENE	3
4-Jun-97	TRICHLOROETHENE	1 J
24-Jun-04	TRICHLOROETHENE	0.9 J
24-Jun-04	PERCHLORATE	1
24-Jun-04	BARIUM	216
24-Jun-04	CALCIUM	119,000
24-Jun-04	CHROMIUM	12.6
24-Jun-04	HEPTACHLOR EPOXIDE	0.2
24-Jun-04	IRON	63.8 J
24-Jun-04	MAGNESIUM	75,600
24-Jun-04	SODIUM	51,700

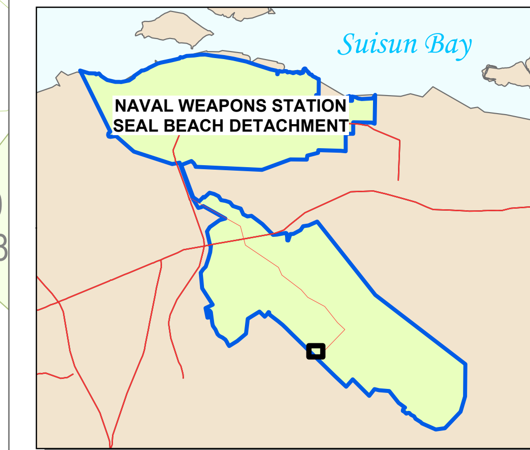
DATE	ANALYTE	RESULT (µg/L)
4-Jun-97	BIS(2-ETHYLHEXYL)PHTHALATE	32
17-Jun-03	PERCHLORATE	0.6
23-Jun-04	PERCHLORATE	1
23-Jun-04	BARIUM	245
23-Jun-04	CALCIUM	114,000
23-Jun-04	CHROMIUM	11.7
23-Jun-04	MAGNESIUM	71,000
23-Jun-04	SODIUM	50,600
23-Jun-04	ZINC	121

DATE	ANALYTE	RESULT (µg/L)
4-Jun-97	BIS(2-ETHYLHEXYL)PHTHALATE	24
24-Jun-04	PERCHLORATE	1
24-Jun-04	BARIUM	258
24-Jun-04	CALCIUM	127,000
24-Jun-04	CHROMIUM	10.6
24-Jun-04	IRON	99.6 J
24-Jun-04	MAGNESIUM	77,100
24-Jun-04	MANGANESE	3.1 J
24-Jun-04	SODIUM	53,100
24-Jun-04	VANADIUM	5.5 J
24-Jun-04	ZINC	192

COMPARISON CRITERIA (µg/L)

ANALYTE	MCL CA	MCL EPA	EPA PRG for Tap Water
1,1,1-TRICHLOROETHANE	200	200	3,200
BARIUM	1,000	2,000	2,600
BIS(2-ETHYLHEXYL)PHTHALATE	4	6	4.8
CALCIUM	--	--	--
CHROMIUM	50	100	55,000
HEPTACHLOR EPOXIDE	0.01	0.2	0.0074
IRON	--	300	11,000
MAGNESIUM	--	--	--
MANGANESE	50	50	880
PERCHLORATE	--	--	3.6
SODIUM	--	--	--
TRICHLOROETHENE	5	5	0.028
VANADIUM	--	--	260
ZINC	--	5,000	11,000

2005-04-07 V:\Concord\Projects\RI_Site 22\s22_GW_Mtl_Pest_Herb_Explsv.mxd TtEMI-SF Aleksandr Zhuk



Monitoring Well Location
Direct Push Boring Location for Grab Groundwater
Building 7SH5 Study Area
Detachment Concord Boundary
Ammunition Magazine
Ditch
Buildings
Street
Railroads
Other Site Feature
Drainage Channel

Notes:
1. Figure shows all detected results during each sampling round at site.
2. Concentrations shown in red exceed the lower of the MCL or PRG for tap water.
3. The grab groundwater sample collected from 7SHB115A was not detected for VOCs.
4. CA = California.
5. EPA = U.S. Environmental Protection Agency.
6. J - Estimated result.
7. MCL = Maximum contaminat level.
8. NA = Not applicable.
9. PRG = Preliminary remediation goal.
10. VOC = Volatile organic compound.
11. µg/L = micrograms per liter.
12. -- = Not available.

N

100 0 100
Feet

Tetra Tech EM Inc.

DETACHMENT CONCORD

FIGURE 9
DETECTED GROUNDWATER ANALYTICAL RESULTS FOR MONITORING WELLS IN THE BUILDING 7SH5 STUDY AREA

1.1.5.1 Initial Assessment Study

A visual inspection of the site was conducted by E&E during the IAS in 1983. The IAS eliminated this site from consideration because of the small quantity of wastes that might be present. Because of changes in law since the IAS (that is, CERCLA and the Superfund Amendments and Reauthorization Act [SARA]) and the absence of records on disposal, this site was included in the SI to evaluate whether it poses an environmental or health risk under current regulations.

1.1.5.2 Site Inspection

The SI at Site 22 was conducted by PRC in June 1992 and included collection of soil samples from three soil borings within a suspected disposal pit and collection and analysis of one composite surface soil sample from the bottom of a drainage ditch.

Soil borings were drilled to a depth of 4 feet within the area of the alleged disposal pit. The soil samples were analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), metals, tributyltin, total petroleum hydrocarbons (TPH)-purgeables, and TPH-extractables.

The results of the SI sampling at the suspected disposal pit did not detect evidence of paints, oils, or solvents; however, it was not certain whether the sampling depth exceeded the pit depth or whether the samples were collected from relatively clean backfill material. Arsenic was the only inorganic chemical in soil detected at concentrations that exceeded the residential PRG; concentrations ranged from 4.0 to 33 mg/kg.

1.1.5.3 Resource Conservation and Recovery Act Facility Assessment

During the RFA conducted by the California Department of Toxic Substances Control (DTSC) in 1992, Building 7SH5 was designated as Solid Waste Management Unit (SWMU) 52 because hazardous waste may have leached into soil from the building’s septic tank system.

Two deep soil borings were advanced in the septic leach field, and two shallow soil borings were advanced along the drainage ditch west of the leach field in 1995 for the RFA. In addition, one liquid sample from the septic tank and a surface water sample from the drainage ditch were collected. All samples were analyzed for VOCs, SVOCs, total oil and grease, and metals. Arsenic was detected at concentrations of 38.0 and 65.4 mg/kg in surface samples from borings 52-03 and 52-04 (Figure 5).

1.1.5.4 Underground Storage Tank Investigation

In September 1993, HLA investigated the UST west of Building 7SH5. One soil boring was drilled to a depth of 16.5 feet below ground surface (bgs) and sampled at 4.5, 8, and 16 feet bgs. Soil samples indicated that TPH as diesel was present in samples collected at depths of 4.5 feet bgs (7,700 mg/kg) and 8 feet bgs (1,600 mg/kg).

The HLA "Subsurface Investigation and Tank Removal Plan" called for the removal of the UST, associated piping, and all contaminated soils until the results indicate residual hydrocarbon levels in soil below 100 mg/kg (HLA 1995). The UST was removed and the surrounding area was investigated in January 1997. Results of the removal showed that the UST was heavily rusted and contained one small hole. Staining was observed on the southern portion of the UST. The soil was overexcavated to approximately 12 feet bgs to remove diesel-contaminated soil (K.T.W. & Associates, Inc. 1998). The UST was replaced under the UST program (HLA 1995). A letter recommending no further action at the UST site was submitted by the Contra Costa County Health Services Department on April 8, 1997 (Contra Costa Health Services Department 1997).

1.1.5.5 Phase I Remedial Investigation

In 1995, three areas around Building 7SH5 were sampled as part of the Phase I RI and feasibility study (FS) to assess whether past site activities affected environmental media at the site. These areas included the drainage ditches, the alleged disposal pit area, and the UST and associated piping. The following description focuses on the results for arsenic, the primary constituent of concern for this investigation. The results for TPH and VOCs are discussed in the Phase I and II RI reports.

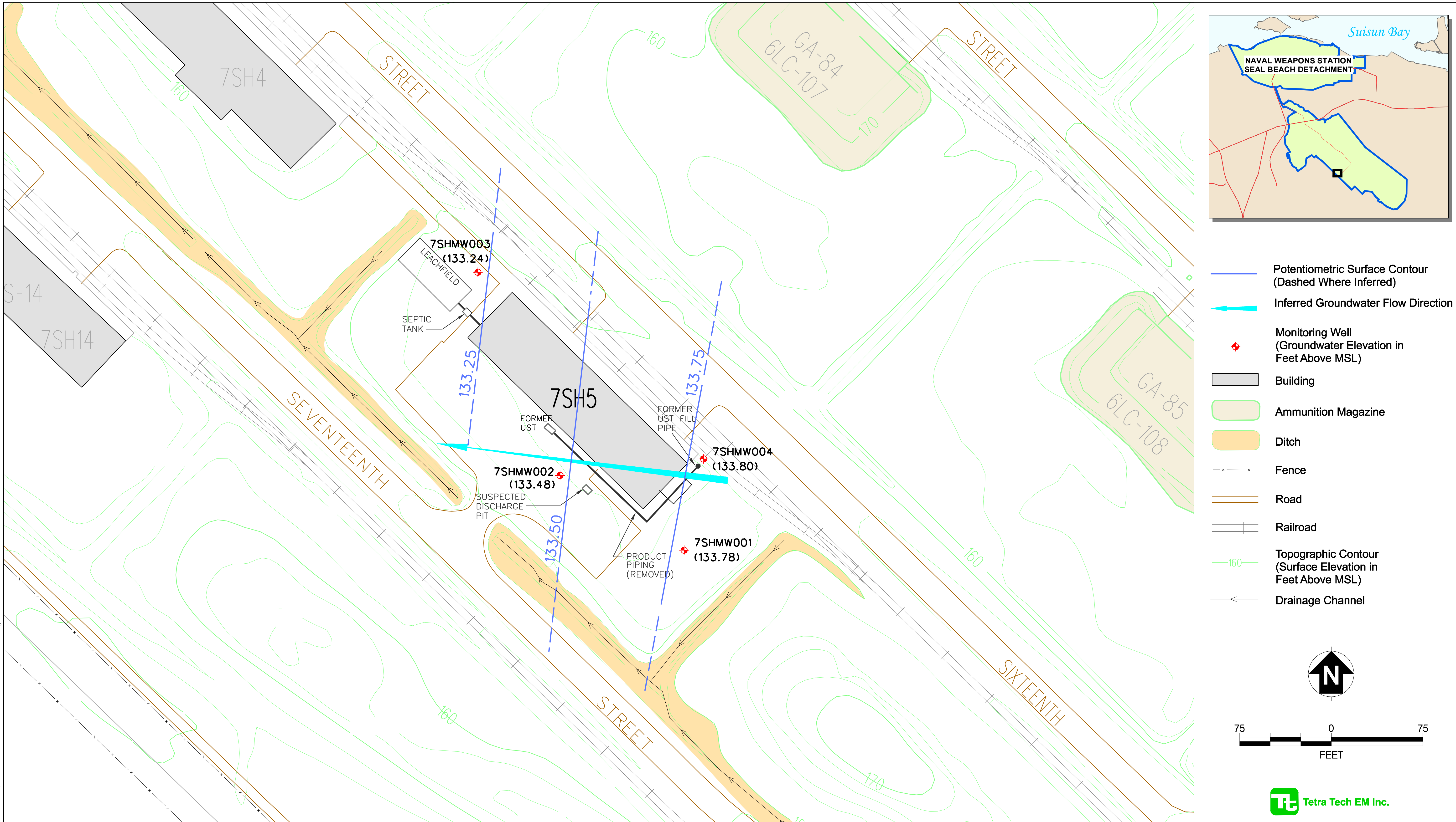
Arsenic concentrations detected in Site 22 surface soils are shown on Figures 4 and 5. Arsenic was detected at concentrations that exceeded the residential and industrial PRG values in the majority of the samples collected at Site 22; however, the ambient concentration of arsenic greatly exceeded the PRG value (10 mg/kg compared with 0.39 mg/kg). The spatial distribution of the elevated concentrations of arsenic suggested that arsenic was not present as a consequence of activities at Building 7SH5.

1.1.5.6 Phase II Remedial Investigation

In 1998, a Phase II RI was conduced to (1) confirm the presence of chlorinated hydrocarbons detected in grab groundwater samples collected during the Phase I RI, and (2) locate the source of contamination once detections were confirmed (Tetra Tech 1998a). Samples were also collected to assess the extent of TPH contamination in groundwater.

Four monitoring wells were installed in January 1997 during the investigation. Soil encountered during installation of the wells consisted primarily of silt and silty clay with varying amounts of sand and gravel. From 0 to 20 feet bgs, discontinuous lenses of gravel and sand were identified within the clay and silt matrix. From 20 to 30 feet bgs, the lithology consists mostly of clayey soil with thin sand gravel lenses.

Soil and groundwater samples were analyzed over four quarters for VOCs and TPH-extractables. The results indicated no evidence of a contaminated groundwater plume (Figure 9). The only VOCs detected were bis(2-ethylhexyl)phthalate, 1,1,1-trichloroethane and trichloroethene (TCE). Groundwater flow measured in April 1997 and October 1997 is to the west-northwest (Tetra Tech 2003). The most recent potentiometric map (June 2004) is shown on Figure 10.



DETACHMENT CONCORD

FIGURE 10
POTENTIOMETRIC SURFACE MAP
JUNE 2004

V:\Concord\Projects\RI_Site 22\GW_Elev_s22.dgn
Lv = 1 - 6, Elev_Jun04
8/5/2005

1.1.5.7 Supplemental Remedial Investigation

The Navy initiated an additional field investigation in response to a concern regarding elevated concentrations of arsenic in soil at Site 22. This investigation (Tetra Tech 2003), conducted in October 2002, involved collection of additional data for soil to characterize the extent of arsenic in soil at Site 22 and to evaluate whether the source of arsenic is anthropogenic.

Results of the supplemental RI indicated that arsenic was elevated in surface soils collected from open grassland and ditch areas of the site when compared with concentrations of arsenic from samples collected near Building 7SH5. These elevated concentrations indicated that the potential source of arsenic may be related to application of arsenic-containing herbicides, pesticides, or rodenticides to surface soils by the Navy or previous landowner or by railroad maintenance practices (Figure 5).

1.1.5.8 Potential Backfill Material for Site 31 Construction

In July 2002, a soil mound east of Building 7SH5 was identified as a possible source of soil to be used as backfill during construction at Site 31 for a time-critical removal action. Before it was used, however, two samples were collected and submitted for analysis for VOCs, SVOCs, metals, pesticides, and polychlorinated biphenyls (PCBs). Arsenic was detected in one sample at a concentration of 17 mg/kg, which exceeds the residential soil PRG (0.39 mg/kg) and Inland Area ambient value for arsenic (10 mg/kg). The elevated arsenic concentrations precluded use of the soil as backfill.

1.1.5.9 Investigation of Arsenic in Soil at Site 22

In 2004, the study area boundary of Site 22 was expanded to include the 250 magazines and open grassland surrounding Building 7SH5. The primary focus of the investigation was to test the Navy's hypothesis that the source of arsenic was related to the widespread application of arsenic-containing herbicides for weed control around the bunkers. Samples collected as part of the June/July 2004 sampling event include:

- 32 surface soil samples (0 to 0.5 feet bgs) for analysis of arsenic in and around the magazines.
- Eight subsurface samples for analysis of arsenic collected at two depth intervals (1 to 1.5 feet bgs and 2.5 to 3 feet bgs) at four locations within the magazine area (borings 7SHSB122, 7SHSB130, 7SHSB146, and 7SHSB150).
- 10 surface soil samples (0 to 0.5 feet bgs) from on base for analysis of arsenic along the fence line southwest of the magazine area at varying distances from the base border.
- 11 surface soil samples for analysis of arsenic outside the boundary of the Magazine Study Area.

- Three plant tissue samples for analysis of arsenic collocated with surface soil sample locations (7HSB116, 7SHB121, and 7SHSB123).
- 24 surface soil samples for analysis of pesticides and herbicides: 15 in the magazine area, 5 along the fence line, and 4 outside the study boundary.
- Three surface soil samples for analysis of explosives in low-lying areas of the site.
- Four groundwater samples for analysis of metals, pesticides, herbicides, VOCs, SVOCs, explosives, and perchlorate from the four existing wells at Building 7SH5.

The results of the sampling indicated the continued presence of arsenic in surface soil at concentrations above the ambient level for arsenic in the Inland Area (10 mg/kg). Concentrations of arsenic across the entire Site 22 Magazine Study Area were generally above ambient (with a maximum concentration of 199 mg/kg at location 7SHSB153), while concentrations collected outside of the study area away from the magazines were below ambient levels (ranging between 2.6 and 6.0 mg/kg) (Figure 4). These results, coupled with the absence of elevated concentrations of arsenic at depth, suggest that the area may have been sprayed with an arsenic-containing herbicide. Arsenic, which remains tightly bound to soil and is unlikely to leach, was not detected in the groundwater samples collected from the monitoring wells at Building 7SH5, located downgradient of the Site 22 Magazine Area (Figure 10). Arsenic was also not detected in the plant tissue samples collected at the site.

Concentrations of pesticides and herbicides in surface soil were below the EPA residential PRGs (EPA 2004) with the exception of dieldrin, which was detected in surface soil sample location 7SHSB134 at a concentration of 0.31 mg/kg (Figure 8). The dieldrin PRG is 0.03 mg/kg. Explosives were not detected in the soil samples.

Results for groundwater samples are presented on Figure 9. The only compounds detected above the maximum contaminant levels (MCL) or EPA PRG for tap water were heptachlor epoxide and TCE in well 7SHMW004. TCE was detected at a concentration of 0.9 micrograms per liter (µg/L); the EPA MCL is 5 µg/L, and the EPA Region IX PRG for tap water is 0.028 µg/L. Heptachlor epoxide was detected at a concentration of 0.2 µg/L; the EPA MCL for this compound is 0.2 µg/L, and the EPA Region IX PRG for tap water is 0.0074 µg/L. Explosives were not detected in any of the groundwater samples. Perchlorate was detected in groundwater at a concentration of 1 µg/L in a sample from each of the wells. This concentration is below the California Public Health Goal, EPA Region IX PRG for tap water (EPA 2004), and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) Environmental Screening Levels (California Regional Water Quality Control Board 2005).

1.1.5.10 Health Consultation

At the Navy's request, ATSDR conducted a health consultation to evaluate potential health hazards from past and current exposures to contaminants originating from Site 22 at Detachment Concord (ATSDR 2005). ATSDR was asked to address the following questions:

- Is there a need to sample the neighboring yards for arsenic contamination?
- Are residents or students attending the neighboring high school exposed to harmful levels of arsenic when dust blows from the base during annual tilling operations?
- Are the results of the soil sampling appropriate for preparing a Human Health Risk Assessment for community exposure to the arsenic?

ATSDR evaluated two potential exposure pathways from arsenic-contaminated soil at Site 22:

- Exposure to neighboring residents (adults and children) from arsenic-contaminated soil from gardening or playing in their yards or on the high school athletic fields.
- Exposure to neighboring residents (adults and children) from arsenic-contaminated dust blown from the base by the wind.

Based on a review of soil data collected at Site 22, ATSDR concluded that incidental exposure to arsenic in the soil would not be expected to harm human health. In addition, ATSDR concluded that if the source of arsenic is the Navy's application of herbicides, it is unlikely that concentrations in the neighboring yards would be higher than the maximum concentrations detected in soil at Site 22 where the actual spraying would have occurred.

Based on ATSDR's review of exposure from airborne arsenic released during tilling operation, ATSDR concluded that the intake would be small and likely below levels that could harm human health. However, ATSDR indicated that short-term exposure to dust could cause minor short-term irritation of the eyes, nose and throat and recommended that the Navy use dust control measures when conducting tilling operations.

ATSDR concluded that the existing Site 22 surface soil sampling data set is appropriate for evaluation of the potential health impacts to the surrounding community using the public health assessment (PHA) process.

Overall, ATSDR classified the site as a 'no apparent public health hazard' which means that although the community may be exposed to base related contaminants, health effects are not expected to result from this exposure.

1.1.5.11 Site 17 Remedial Investigation – Sediment Samples

Three surface sediment samples (ACSSB029 through ACSSB031) were collected in Mount Diablo/Seal Creek as part of the RI conducted at Site 17 in 1997 (Building IA-24) (Tetra Tech 1997) (Figure 2). Site 17, which was formerly used for forklift maintenance and battery service, is located downstream of Site 22, along the eastern side of Kinne Boulevard. As part of forklift maintenance, the forklifts and batteries were steam cleaned to remove oil and grease. The oil and grease removed were discharged to Mount Diablo/Seal Creek from a pipe that extended from the building. The sediment samples were collected 50 feet upstream and 50 feet downstream of the former steam cleaning outfalls. Samples were submitted for analysis of TPH-extractables, TPH-purgeables, SVOCs, metals and pH.

Arsenic was detected in these samples at concentrations ranging between 4.8 and 5.7 mg/kg. These concentrations are above the residential PRG, but below the ambient concentration (Tetra Tech 1997). None of the other metals detected was present at concentrations that exceeded the residential PRG (EPA 2004).

1.1.5.12 Surface Water Ambient Monitoring Program

As part of the Surface Water Ambient Monitoring Program (SWAMP), one surface sediment sample was collected in Seal Creek at the Point Chicago Bridge in April 2003. Arsenic was detected in the sample at a concentration of 4.58 mg/kg (San Francisco Bay Regional Water Quality Control Board [SFBRWQCB] 2005).

1.1.6 Principal Decision-Makers

Principal decision-makers for Detachment Concord include the Navy and the regulatory agencies. The lead regulatory agency is the U.S. EPA. Other principal decision-makers include the SFBRWQCB, the California DTSC, and the California Department of Fish and Game (CDFG). The decision-makers will use the data to identify risks to human health and the environment and make management decisions to protect human health and the environment.

1.1.7 Technical or Regulatory Standards

Data for soil and sediment will be screened against the following criteria to identify potential risks to human health and the environment:

- The ambient concentration for arsenic in soil in the Site 22 Inland Area (10 mg/kg) (Tetra Tech 1997)
- EPA Region IX PRG for arsenic for residential soil (0.39 mg/kg) (EPA 2004)

1.2 PROJECT DESCRIPTION

This section discusses the objectives and measurements of the project.

1.2.1 Project Objectives

As stated in Section 1.1.1, the main purpose of this investigation will be to evaluate the impact of past application of arsenic-containing herbicides in the Inland Area. Data collected as part of the additional investigation will be used to: (1) assess whether application of arsenic-containing herbicides in the Site 22 Magazine Area has affected the off-site area southwest of the fence line and pose a risk; (2) assess whether arsenic-containing herbicides were also applied in the other Inland Area Magazine Areas; and (3) evaluate whether arsenic-contaminated soil has been transported to Mount Diablo/Seal Creek via surface water flow.

To meet these objectives, the following field activities will be conducted:

- Collect 20 surface soil samples (0 to 0.5 feet bgs) for analysis of arsenic from the off-site properties (Figure 4). Surface soil samples will be collected along a transect that will extend from previous sampling locations collected along the fence line. Samples will be collected at two distances from the fence line (2 feet and 10.5 feet). These distances are based on the estimated spray radius from application of herbicides, as discussed in Section 1.3.

- Collect a total of 15 discrete sediment samples (0 to 0.5 feet bgs) from nine sampling locations along Mount Diablo/Seal Creek (Figure 7). [Three discrete samples will be collected from each of locations 7SHSD007 through 7SHSD009.] The EPA, assisted by representatives from DTSC, the RWQCB, and CA DFG field-located the six samples to be collected at the most downstream end of Mount Diablo/Seal Creek (Figure 7) during a site walk with the Navy on September 23, 2005. Samples are referred to as sediment, but the creek is ephemeral and is likely to be dry when samples are collected.

- Collect sediment samples (0 to 0.5 feet bgs) from six sampling locations in low-lying areas within the western portion of the Site 22 Magazine Area and three sampling locations within the southeastern portion of Site 22 Magazine Area in the abandoned Clayton Canal (Figure 7). The EPA, assisted by representatives from the RWQCB and CA DFG also field-located these nine sampling locations during the site walk on September 23, 2005. Samples are referred to as sediment, but the areas may be dry when samples are collected.

- Collect a total of 30 (thirty) surface soil samples (0 to 0.5 feet bgs) for analysis of arsenic from the other Inland Area magazines (Magazines A through D) (Figure 3). The number of samples collected from each magazine area is based on the areal extent of the study boundary. Sample locations were selected randomly. Based on feedback from EPA, the number of samples in these areas was increased from the 20 proposed in the Draft Final SAP.

- Collect up to four surface soil samples; two from previous Site 22 Magazine Area sample locations (7SHSB121 and 7SHSB153) and two from the off-site area locations (7SHSB185 and 7SHSB189) to assess the bioavailability of arsenic present in soil. Bioavailability is an important issue when evaluating exposure to arsenic in soil because arsenic in this medium may be less completely absorbed than the same dose administered in the toxicity studies conducted to determine the non-cancer reference dose or cancer slope factor for use in risk assessment. In these toxicity studies, arsenic was delivered dissolved in solution in food and drinking water. However, the solubility and bioavailabilty of arsenic in soil is typically reduced due to interactions with soil constituents (i.e., processes such as adsorption to soil particles and coprecipitation with other soil species). Thus, the collection of this bioavailability data will result in more accurately quantified potential health risks from exposure to soil at Site 22. The test method for measuring bioavailabilty is described in detail in Appendix B.

The implementation schedule for the SAP and sampling is presented in Table 3.

TABLE 3: IMPLEMENTATION SCHEDULE FOR SAMPLING, ANALYSIS, AND REPORTING

Final SAP, Additional Investigation at Site 22 - Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Milestone	Due Date	Anticipated Date
Draft SAP to Agencies	May 9, 2005	*May 9, 2005
Receipt of Agency Comments on Draft SAP	60 calendar days after SAP is submitted to agencies	*July 8, 2005
Draft Final SAP and RTCs	60 calendar days after receipt of agency comments	*September 2, 2005
Final SAP	November 7, 2005	November 2, 2005
Health and Safety Plans to Navy	30 calendar days before field investigation to begin	November 6, 2005
Field Work	21 working days after finalization of SAP	December 6, 2005 (Creek sediment sampling to be conducted earlier to avoid significant rain events)
Draft RI Report	February 3, 2006	Current SMP date; extension may be requested to account for delay in SAP finalization.

Notes:
* Completed

RTC Responses to comments
SAP Sampling and analysis plan

1.2.2 Project Measurements

Project measurements will include laboratory analyses. Samples collected during this investigation will be analyzed for arsenic by EPA Method 6020 SW-846 with a subset also analyzed for bioavailability. Table E-1 presents the project-required reporting limits for arsenic and compares this value with the applicable screening criteria discussed in Section 1.4. Project measurements for soil are discussed in detail in Section 2.0 of this SAP.

1.3 QUALITY OBJECTIVES AND CRITERIA

This section summarizes the data quality objectives (DQO) and measurement quality objectives (MQO) identified for this project.

1.3.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000b, 2000d). DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. Table 4 presents the seven steps of the DQO process for this project.

1.3.2 Measurement Quality Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project objectives. Of these PARCC parameters, precision and accuracy will be evaluated quantitatively by collecting the quality control (QC) samples listed in Table 5. Appendix C lists the specific precision and accuracy goals for the QC samples.

The sections below describe each of the PARCC parameters and how they will be assessed within this project.

1.3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD), using the equation presented below.

TABLE 4: DATA QUALITY OBJECTIVES

Final SAP, Additional Investigation at Site 22 - Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 1: State the Problem
As discussed in Section 1.1, the Site 22 investigation area initially consisted of Building 7SH5, a former missile and wing repair facility. However, the site boundary was later expanded to include the adjacent 250 magazines after concentrations of arsenic were repeatedly detected in surface soil at concentrations above the ambient value of 10 mg/kg in open grasslands near the building and in light of the absence of any known source of arsenic at the building. A newspaper article from the *Contra Costa Gazette* dated May 10, 1947, was located during the Navy's review of other potential sources of arsenic in the area. This article reported that the Navy had sprayed an arsenic-containing solution (referred to in the article as sodium arsenite) on "undergrowth on top and within 50 feet of munition dumps in the HE No. 3 area to kill tall grass" that represented a fire hazard (*Contra Costa Gazette* 1947). Although the Site 22 magazines were not identified in the article as an area that was sprayed, the Navy hypothesized that arsenic-containing solution could have been sprayed in the open grassland near Building 7SH5 for weed control to protect the magazines from fire danger and/or on agricultural farmland before the Navy owned the site. If the area was sprayed, it was hypothesized that the arsenic contamination would be widespread. The Navy's hypothesis is supported by results from the June/July 2004 sampling of the Site 22 Magazine Area. Uniformly high concentrations of arsenic were detected in surface soil samples collected within and among the magazine, while concentrations of arsenic outside the study boundary and at depth were significantly lower (consistent with ambient concentrations) (Figure 4). The concentrations of arsenic detected and the spatial relationship of the contamination suggests a pattern consistent with surface application of herbicides. It is unknown whether application of arsenic-containing herbicides within the magazine areas at Detachment Concord has affected off-site properties and, if so, whether the concentrations of arsenic pose an unacceptable risk to human health. If Navy-related arsenic contamination is present in off-site soil, it most likely would have resulted from historical spraying activities along the fence line separating the Navy and off-site properties. Therefore, additional sampling and analysis are being proposed to characterize arsenic concentrations in soil at off-site properties adjacent to the fence line located along a portion of the southwestern boundary of the Navy's property. . The regulatory agencies have questioned whether arsenic from the magazine area has migrated off-site to Mount Diablo/Seal Creek, and, if so, whether concentrations are at levels that pose an unacceptable risk to human health and the environment. To date, the Navy has not analyzed concentrations of arsenic in sediment from Mount Diablo/Seal Creek. The Navy proposes to address this question using a phased approach, where the first phase will be addressed in this set of DQOs, and consists of collecting sediment samples along the creek to evaluate whether arsenic is present at concentrations above ambient levels. During a site visit on September 23, 2005, the regulatory agencies also questioned whether concentrations of arsenic are elevated in the low-lying areas of the western portion of the site, referred to as Drainage Areas A and B on Figure 6A, and in southeastern portion of the site within the abandoned Clayton Canal (Figure 7), and, if so, whether arsenic is present at concentrations above ambient levels. As requested, additional sampling is proposed in these areas. The Navy has conducted soil sampling for arsenic at the Site 22 Magazines. Four smaller magazine areas within the Inland Area, however, have not been sampled for analysis of arsenic. Additional sampling is proposed to assess whether arsenic concentrations are elevated in these areas.

TABLE 4: DATA QUALITY OBJECTIVES (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 1: State the Problem (Continued)

Data is also needed to determine the bioavailability of the arsenic that is present. Bioavailability is an important issue when evaluating exposure to arsenic in soil because arsenic in this medium may be less completely absorbed than the same dose administered in the toxicity studies conducted to determine the non-cancer reference dose or cancer slope factor for use in risk assessment. In these studies, arsenic was delivered dissolved in solution in food and drinking water. However, the solubility and bioavailabilty of arsenic in soil is typically reduced due to interactions with soil constituents (i.e., processes such as adsorption to soil particles and coprecipitation with other soil species). Therefore, collecting bioavailability data from soil and using this data in the risk assessment can result in more accurately quantified potential health risks for exposures from this medium. The Navy's proposal for the collection of bioavailability samples is provided under Step 3. Bioavailability results will be used to support the risk calculations described for decision (1) under Step 2.

STEP 2: Identify the Decisions

(1) Are concentrations of arsenic in soil at off-site properties adjacent to the southwestern border of Detachment Concord at levels sufficient to pose an unacceptable risk to human health and, if so, is there any evidence that application of arsenic-containing herbicides at the nearby magazine area is the primary source?

(2) Are concentrations of arsenic in sediments along Mount Diablo/Seal Creek above ambient levels (10 mg/kg)?

(3) Are concentrations of arsenic in sediment in the low-lying areas of the western portion of Site 22 above the ambient level (10 mg/kg)?

(4) Are concentrations of arsenic in sediment in the southeastern portion of Site 22 within the abandoned Clayton Canal above the ambient level (10 mg/kg)?

(5) Are concentrations of arsenic in soil at four additional magazine areas above the ambient screening level (10 mg/kg)?

STEP 3: Identify Inputs to the Decisions

- Validated analytical data for arsenic in surface soil (0-0.5 feet below ground surface [bgs]) collected from the four magazine areas, the off-site properties located along the southwestern border of Navy's property; and surface sediment (0-0.5 feet bgs) along Mount Diablo/Seal Creek, in Drainage Areas A and B, and in the abandoned Clayton Canal.
- Bioavailabilty results for arsenic from four samples; two collected from previous Site 22 Inland Area surface sample locations 7SHSB153 and 7SHSB121 and two from proposed off-site sample locations 7SHSB185 and 7SHSB189. The highest (most conservative) bioavailability estimate will be used in the risk calculations that support decision (1) described under Step 2.
- U.S. EPA Region IX Residential PRG for arsenic (0.39 mg/kg)
- Ambient screening level for arsenic (10 mg/kg)

TABLE 4: DATA QUALITY OBJECTIVES (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 4: Define Study Boundaries

The spatial boundaries for this investigation are defined separately for each of the three study components, as shown on Figures 3, 4, and 6A and 6B and described below:

(1) Surface soil (0-0.5 feet below ground surface [bgs]) within a corridor on both sides of the fence line that separates Navy and off-site properties along a section of the southwestern border of Detachment Concord. The corridor extends 10.5 feet into the interior of the off-site properties. The length of the corridor is approximately 7,500 feet.

(2) Surface sediment (0-0.5 foot bgs) along the section of Mount Diablo/Seal Creek, shown on Figure 7.

(3) Surface sediment (0-0.5 foot bgs) in the western portion of the site (Figure 7).

(4) Surface sediment (0-0.5 foot bgs) in the southeastern portion of the site within the abandoned Clayton Canal (Figure 7).

(5) Surface soil (0-0.5 foot bgs) at four magazine areas. The four magazine areas cover approximately 154 acres for Magazine A, 39 acres for Magazine B, 124 acres for Magazine C, and 185 acres for Magazine D.

Temporal boundaries are defined by the project duration as shown on Table 3.

STEP 5: Develop Decision Rules

(1a) If arsenic in soil at the off-site properties is within ambient levels (determined through two-population statistical tests) or if the cancer risks and adverse non-cancer health hazards estimated from exposure to arsenic in soil at the off-site properties are acceptable (cancer risk less than 1 X 10^{-6}; non-cancer hazard index less than 1), then it will be concluded that arsenic does not pose an unacceptable risk to human health, and no further action will be proposed. If the cancer risk falls within the 1 X 10^{-4} to 1 X 10^{-6} risk management range, then the Navy will discuss potential follow-up actions with the regulatory agencies.

(1b) If the cancer risk estimated from exposure to arsenic in soil at the off-site properties exceeds the risk management range or if the non-cancer hazard index exceeds 1, then it will be concluded that arsenic poses an unacceptable risk to human health. In this case, additional analysis will be conducted to determine if there is any evidence that application of arsenic-containing herbicides at the magazine area is the primary source.

(1c) In the event that arsenic in off-site soil poses an unacceptable risk to human health, the Navy will review the trend in arsenic concentrations with distance away from the fence line to assess whether the magazine area is the primary source of arsenic. This evaluation will include comparing arsenic concentrations in a set of off-site samples collected immediately adjacent to the fence line to concentrations of arsenic in a set of samples collected at a greater distance from the fence line in a direction toward the interior of the off-site properties. In addition, the Navy will evaluate the general pattern of arsenic concentrations along a series of 10 transects positioned perpendicular to the fence line and running from the Navy's property to a fixed distance toward the interior of the off-site properties. Professional judgment will be used to weigh the strength of evidence that a significant spatial pattern of arsenic concentrations is present. If it is determined that concentrations of arsenic are significantly higher along the fence line and decrease with increasing distance from the fence line in both directions (that is, moving away from the fence line toward the interior of the Navy property and off-site properties), then it will be concluded that application of arsenic-containing herbicides along the fence line is the likely source of arsenic measured in soil at the off-site properties. If no spatial pattern is shown for concentrations of arsenic in soil along both sides of the fence line, then it will be concluded that there is insufficient evidence to link concentrations of arsenic in off-site soil to historical application of arsenic-containing herbicides within the magazine area.

TABLE 4: DATA QUALITY OBJECTIVES (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 5: Develop Decision Rules (Continued)
(2a) If concentrations of arsenic in sediment samples collected at locations along Mount Diablo/Seal Creek downgradient from the Site 22 Magazine Area do not exceed the ambient level (10 mg/kg), then no further action will be proposed.
(2b) If concentrations of arsenic in one or more sediment samples collected downgradient from the Site 22 Magazine Area are elevated when compared with the ambient level (10 mg/kg), and samples collected from an upgradient location are below the ambient level, then the Navy will initiate an investigation to assess whether arsenic measured in Mount Diablo/Seal Creek might have originated from Navy sources.
(2c) If concentrations of arsenic in sediment samples collected both downgradient and upgradient from the Site 22 Magazine Area are elevated with respect to the ambient level (10 mg/kg), then the Navy will discuss appropriate follow-up actions with the regulatory agencies.
(3a) If concentrations of arsenic in sediment samples collected in the low-lying areas of the western portion of Site 22 do not exceed the ambient level (10 mg/kg), then no further action will be proposed.
(3b) If concentrations of arsenic in sediment samples collected in low-lying areas of the western portion of Site 22 exceed the ambient level (10 mg/kg), then the Navy will discuss appropriate follow-up actions with the regulatory agencies.
(4a) If concentrations of arsenic in sediment samples collected in the southeastern portion of Site 22 within the abandoned Clayton Canal do not exceed the ambient level (10 mg/kg), then no further action will be proposed.
(4b) If concentrations of arsenic in sediment samples collected in the southeastern portion of Site 22, within the abandoned Clayton Canal, exceed the ambient level (10 mg/kg), then the Navy will discuss appropriate follow-up actions with the regulatory agencies.
(5a) Decisions will be made individually for each of the four other Inland Area magazine areas included in this investigation. If arsenic in surface soil at any of the additional magazine areas exceeds the ambient level for arsenic, additional investigation may be warranted, as well as an ecological and human health risk assessment.
(5b) If arsenic soil concentrations at any of the additional magazine areas is below the ambient level (10 mg/kg), no further action will be proposed.
STEP 6: Specify Tolerable Limits on Decision Errors
Decision errors associated with risk assessment conclusions are difficult to assess quantitatively, as there are multiple factors that contribute to the overall likelihood that incorrect decisions will be made. For this reason, tolerable limits on decision errors are typically specified for only selected factors, such as the sampling error in estimating exposure point concentrations. The decision errors associated with each of the three study components described in Step 2 of these DQOs are defined below. The first study component involves a large number of samples so that statistical analysis is possible and a more definitive discussion of decision errors can be provided. The second, third, and fourth study components involve a limited number of samples and only a general discussion of decision errors is warranted.

TABLE 4: DATA QUALITY OBJECTIVES (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 6: Specify Tolerable Limits on Decision Errors (Continued)
(1) Two decision errors are defined for the first element of this study component: (a) concluding that arsenic in off-site soil does not pose a risk to human health when unacceptable risk is present (this error is a Type I, or false negative), and (b) concluding that unacceptable risk is present when the actual risk is below a level of concern (this error is a Type II, or false positive). The proposed study design addresses decision errors associated with the sampling error, which affects the precision of the estimated exposure point concentration. The sample size for the design was selected using professional judgment and establishes two additional sampling locations along 10 existing transects. The 10 transects run perpendicular to the fence line and extend from the fence line toward the interior of Detachment Concord. The two additional sampling locations will be established within the off-site properties and will extend the existing transects approximately 10.5 feet from the fence line in a direction toward the interior of the off-site properties. Risk estimates will be based on calculations of an exposure point concentration for the pooled group of 20 off-site samples. Assuring that the mean concentration of arsenic is estimated with acceptable precision (margin of error) and confidence will control decision errors. Existing data from the 10 transects were used to calculate a relative standard deviation of 0.50 to 1.0 (50 to 100 percent) for arsenic in surface soil. If the relative standard deviation of the newly collected data is assumed to be no greater than 1.0, then 20 samples will provide 95 percent confidence that the true mean concentration of arsenic in the off-site properties will be within plus or minus 40 percent of the sample mean. If unacceptable risk is present, then additional decision errors are associated with a follow-up analysis aimed at determining whether historical application of arsenic-containing herbicides is the likely source of contamination in off-site soil. A Type I (false negative) error occurs if it is incorrectly concluded that application of arsenic-containing herbicides is not the primary source of arsenic measured in off-site soil. A Type II (false positive) error occurs if it is incorrectly concluded that the application of arsenic-containing herbicides is the primary source of arsenic measured in off-site soil. The follow up analysis will rely primarily on qualitative assessments of the data, and professional judgment will be used to draw conclusions. No quantitative decision errors are specified for this follow-up analysis.
(2) Two decision errors are defined for this component of the study: (a) concluding that concentrations of arsenic in sediment collected from Mount Diablo/Seal Creek are below ambient levels when concentrations are actually above ambient (this error is a Type I or false negative), and (b) concluding that concentrations of arsenic in sediment exceed ambient levels when concentrations are actually below ambient (this error is a Type II, or false positive). The regulatory agencies and the Navy established the sample size and sampling locations for this component of the study using professional judgment. The data from this investigation will be evaluated only qualitatively; therefore, quantitative limits will not be established for decision errors.
(3) Two decision errors are defined for this component of the study: (a) concluding that concentrations of arsenic in sediment collected in the western portion of Site 22 are below ambient levels when concentrations are actually above ambient (this error is a Type I or false negative), and (b) concluding that concentrations of arsenic in sediment exceed ambient levels when concentrations are actually below ambient (this error is a Type II, or false positive). The regulatory agencies and the Navy selected the sample size and sampling locations for this component of the study using professional judgment. The data from this initial phase of the investigation will be evaluated only qualitatively; therefore, quantitative limits will not be established for decision errors.

STEP 6: Specify Tolerable Limits on Decision Errors (Continued)

(4) Two decision errors are defined for this component of the study: (a) concluding that concentrations of arsenic in sediment collected in the southeastern portion of Site 22 within the abandoned Clayton Canal are below ambient levels when concentrations are actually above ambient (this error is a Type I or false negative), and (b) concluding that concentrations of arsenic in sediment exceed ambient levels when concentrations are actually below ambient (this error is a Type II, or false positive). The regulatory agencies and the Navy selected the sample size and sampling locations for this component of the study using professional judgment. The data from this investigation will be evaluated only qualitatively; therefore, quantitative limits will not be established for decision errors.

(5) The sample size for characterizing the four additional magazine areas was selected using professional judgment, and the total number of sampling locations was apportioned among the four areas according to the relative size (surface area) of each.

STEP 7: Optimize the Sampling Design

The following summarize the steps taken to optimize the sampling designs for each study component:

(1) The sampling design for off-site properties addresses the working hypothesis that historical application of arsenic-containing herbicide along the fence line that separates Navy and neighboring properties may have resulted in contamination of neighboring properties. The Navy conducted a review of the technical literature and consulted experts familiar with the application of herbicides to establish the likely drift ranges for arsenical herbicides applied along the fence line. The following assumptions were used in this assessment:

- Herbicides were applied with a boom-type ground sprayer equipped with a standard flat-spray nozzle, with
  - The boom height approximately 18 inches above the target area
  - The spray pressure between 30 and 40 pounds per square inch
- The spray nozzles were spaced 20-inches apart on the boom, with a spray angle of approximately 80 degrees
- Wind speeds were less than 10 miles per hour during application
- Air stability had no effect on pesticide drift

Based on these assumptions, two zones were identified to estimate the expected concentration of arsenic as a function of increasing distance from the fence line, if spraying of arsenic-containing herbicides was the true source of arsenic in surface soil at the neighboring properties. The highest concentrations of arsenic resulting from spraying herbicides along the fence line would be expected at a distance of 0 to 4 feet from the fence line. If drift is taken into account, a second zone of lower concentrations might be expected at a distance of 4 to 17 feet from the fence line. The mid-point of each zone (that is 2 feet for the zone closest to the fence line, and 10.5 feet for the zone farther away) was selected to collect two samples from each of 10 sampling locations. The 10 locations correspond to previous transects established perpendicular to the fence line within the boundary of Detachment Concord. The transects were established using a random starting position and spacing adjacent locations at equal distances. The two additional samples at each of 10 locations (20 samples total) extend each transect a distance of 10.5 feet into the interior of the neighboring properties. If access is denied or for any other reason it is not possible to collect a sample along any of the existing transects, an alternate transect will be selected. Alternate transects will be designated using a random distance and direction (north or south) from the existing transect. The random distance will be limited to between 100 and 800 feet, to assure at least 100 feet of separation between any two transects (the existing transects are spaced approximately 900 feet apart). If samples cannot be collected at the first alternate location, then a second alternate (and so forth) will be selected.

TABLE 4: DATA QUALITY OBJECTIVES (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 7: Optimize the Sampling Design (Continued)
The design provides for pooling the 20 off-site samples, and calculating an average concentration of arsenic in surface soil for a rectangular zone that runs along the length of the fence line, and extends a distance of 10.5 feet into the interior of the neighboring properties. If the risk resulting from exposure to the average concentration of arsenic (estimated by calculating an upper confidence limit of the sample mean) in soil exceeds the risk management range, then the spatial pattern of arsenic concentrations can be further evaluated to assess whether application of arsenical pesticides is the likely source of contamination. This additional evaluation will include comparing concentrations of arsenic between two groups of off-site samples (10 samples in the zone closest to the fence line, and 10 samples in the zone centered approximately 10.5 feet from the fence line). Then, trends will be examined in concentrations along individual transects extending from inside the fence line on Navy property to a distance of 10.5 feet toward the interior of the off-site properties.
(2) The design for Mount Diablo/Seal Creek establishes nine sediment sampling location along Mount Diablo Seal Creek (Figure 7). The locations were established in areas identified by the Navy and regulatory agencies as depositional environments during site walks in January and September 2005. One sample will be collected at each location from 0 to 0.5 feet bgs, with the exception of locations 7SHSD007 through 7SHSD009 where three discrete samples will be collected per location. Thus a total of 15 discrete samples of creek soil/sediment will be collected.
(3) Six sampling locations were identified in low-lying area of the western portion of the Site 22 Magazine Area, and three locations were identified in the southeastern portion of the Site 22 Magazine Area in the abandoned Clayton Canal. The regulatory agencies selected these locations during the site visit conducted in September 2005. One sample will be collected at each location from 0 to 0.5 feet bgs.
(4) A total of 30 samples of surface soil (0-0.5 foot bgs) will be collected from four additional magazine areas (identified as A, B, C, and D on Figure 3). The number of sampling locations at each area was calculated using a stratified design, where the total number of samples was apportioned to the individual areas according to relative size. The total area of all four magazine areas is 459 acres, as follows: area A (154 acres), area B (39 acres), area C (124 acres), and area D (185 acres). The calculated sample sizes are for 8 for area A, 4 for area B, 8 for area C, and 10 for area D. Sampling locations were selected for individual magazine areas using a triangular grid with a random starting position. The grid dimensions were determined based on the size and shape of each area, as well as the number of sampling locations.

Notes:

bgs Below ground surface

SAP Sampling and analysis plan

TABLE 5: QC SAMPLES FOR PRECISION AND ACCURACY

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

QC Type[a]	QC Type	Analysis	Frequency	Rationale
Laboratory QC	MS Method and Reagent Blanks LCS or Blank Spikes MD	Same analytes as sampled during the related field event	MS= 1/20 samples per field event Method blank = 1/20 samples per field event Reagent blank = 1/extraction fluid batch LCS or blank spikes = 1/20 samples per field event MD = 1/20 samples per field event	Evaluate laboratory results for precision and accuracy.

Notes:

a Disposable sampling equipment will be used. No equipment rinsate blanks, therefore, are proposed.

%R Percent recovery
LCS Laboratory control sample
MD Matrix duplicate
MS Matrix spike
QC Quality control
SAP Sampling and analysis plan

$$RPD = \frac{|A - B|}{(A + B)/2} \quad x \quad 100\%$$

where:

A = First duplicate concentration

B = Second duplicate concentration

Field sampling precision is typically evaluated by collecting duplicate samples. Because of the heterogeneous nature of the soil, duplicate samples will not be collected.

Laboratory analytical precision is evaluated by analyzing laboratory duplicates or matrix spikes (MS) and matrix spike duplicates (MSD). For this project, MS/MSD samples will be analyzed of each laboratory duplicate and the MS/MSD pair will be used to calculate an RPD for evaluating precision.

1.3.2.2 Accuracy

Sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control samples (LCS) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent for soil and groundwater samples. LCS or blank spikes are also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic compounds. Results of the spiked samples are used to calculate the percent recovery (%R) for evaluating accuracy.

$$\%R = \frac{S - C}{T} \quad x \quad 100$$

where:

S = Measured spike sample concentration

C = Sample concentration

T = True or actual concentration of the spike

Appendix C presents accuracy goals for the investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be evaluated further based on the results of other QC samples.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. Representative data will be obtained for this project through careful selection of sampling locations and analytical parameters. Representative data also will be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will be ensured through the consistent application of established field and laboratory procedures. Equipment rinsate blanks and laboratory blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be nonrepresentative based on comparison with existing data will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

1.3.2.4 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP and when none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

Completeness also will be evaluated as part of the data quality assessment process (EPA 2000c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

1.3.2.6 Detection and Quantitation Limits

The method detection limit (MDL), which are presented in Appendix E, is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix. PRRLs are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the MDL to allow for matrix effects. PRRLs, which Tetra Tech establishes in the scope of work for subcontract laboratories, are set to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower.

1.4 PROJECT ORGANIZATION

Table 6 presents the responsibilities and contact information for key personnel involved in this investigation. In some cases, more than one responsibility has been assigned to one person. Figure 11 presents the organization of the project team.

TABLE 6: KEY PERSONNEL

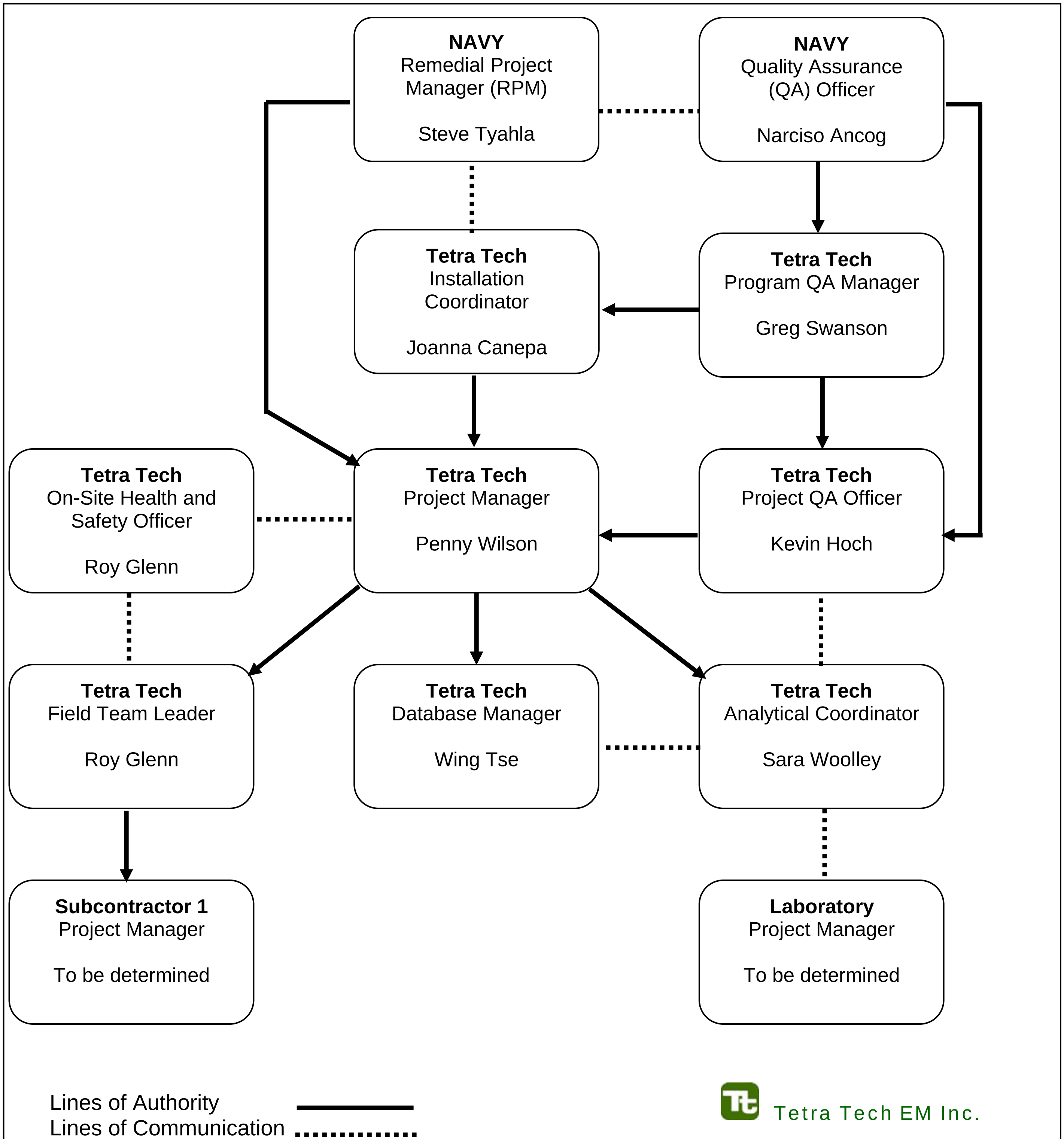
Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Name	Organization	Role	Responsibilities	Contact Information
Steve Tyahla	Navy	Remedial project manager	Responsible for overall project execution and coordination with base representatives, regulatory agencies, and Navy management personnel. Participates actively in the DQO process. Provides management and technical oversight during data collection.	Naval Facilities Engineering Command, Integrated Product Team West, San Bruno, CA tyahlasf@efawest.navfac.navy.mil (650-746-7451)
Narciso A. Ancog	Navy	QA officer	Responsible for QA issues for all SWDIV environmental work. Provides government oversight of the Tetra Tech QA program. Reviews and approves the SAP and any significant modifications. Has authority to suspend project activities if Navy quality requirements are not met.	Naval Facilities Engineering Command, Southwest Division, San Diego, CA narciso.ancog@navy.mil (619) 532-3046
Greg Swanson	Tetra Tech	Program QA manager	Responsible for regular discussion and resolution of QA issues with Navy QA officer. Provides program-level QA guidance to the installation coordinator, project manager, and the Tetra Tech Teams. Reviews and approves SAPs. Identifies nonconformances through audits and other QA review activities. Recommends corrective actions.	Tetra Tech, San Diego, CA greg.swanson@ttemi.com (619) 525-7188
Kevin Hoch	Tetra Tech	Project QA officer	Responsible for providing guidance to Tetra Tech Teams that are preparing SAPs. Verifies that data collection methods specified in the SAP comply with Navy and Tetra Tech Team requirements. Conducts laboratory evaluations and audits, as necessary.	Tetra Tech, San Francisco, CA kevin.hoch@ttemi.com (415) 222-8304
Joanna Canepa	Tetra Tech	Installation coordinator	Responsible for ensuring that all Tetra Tech activities at this installation are carried out in accordance with current Navy requirements.	Tetra Tech, Seattle, WA joanna.canepa@ttemi.com (425) 673-3652
Penny Wilson	Tetra Tech	Project manager	Responsible for implementing all activities specified in the delivery order. Supervises preparation of the SAP by the Tetra Tech Team. Monitors and directs field activities to ensure compliance with the SAP.	Tetra Tech, San Francisco, CA penny.wilson@ttemi.com (415) 222-8203
Roy Glenn	Tetra Tech	Field team lead	Responsible for directing day-to-day field activities conducted by the Tetra Tech Team and subcontractor personnel and providing technical support for the project. Verifies that field sampling and measurement procedures follow the SAP. Provides the project manager with regular reports on status of field activities.	Tetra Tech, San Francisco, CA roy.glenn@ttemi.com (415) 222-8283

TABLE 6: KEY PERSONNEL (Continued)
Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Name	Organization	Role	Responsibilities	Contact Information
Roy Glenn	Tetra Tech	On-site safety officer	Responsible for implementing the health and safety plan, determining appropriate site control measures, and identifying personal protection levels. Leads daily safety briefings for the Tetra Tech, subcontractor personnel, and site visitors. Has authority to suspend operations that threaten health and safety.	Tetra Tech, San Francisco, CA roy.glenn@ttemi.com (415) 222-8226
Sara Woolley	Tetra Tech	Analytical coordinator	Responsible for working with the Tetra Tech Team to define analytical requirements. Assists in selection of a laboratory to complete required analyses (see Section 2.4 of SAP). Coordinates with the laboratory project manager on analytical requirements, delivery schedules, and logistics. Reviews laboratory data before they are released to the Tetra Tech Team.	Tetra Tech, San Francisco, CA sara.woolley@ttemi.com (415) 222-8311
Wing Tse	Tetra Tech	Database manager	Responsible for developing, monitoring, and maintaining project database under guidance of the project manager. Works with the project chemist to resolve sample identification issues during preparation of the SAP.	Tetra Tech, San Francisco, CA wing.tse@ttemi.com (415) 222-8326
To be determined	Laboratory	Project manager	Responsible for delivering analytical services that meet the requirements of the SAP. Reviews and understands all analytical requirements in the SAP. Works with the project chemist to confirm sample delivery schedules. Reviews the laboratory data package before it is delivered to the project chemist.	

Notes:
DQO Data quality objective
Navy U.S. Department of the Navy
QA Quality assurance
SAP Sampling and analysis plan
Tetra Tech Tetra Tech EM Inc.



Naval Weapons Station Seal Beach Detachment
Concord, California
Integrated Product Team West, Daly City

FIGURE 11
PROJECT TEAM ORGANIZATION CHART

1.5 SPECIAL TRAINING AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP and describe the requirements for Tetra Tech and subcontractor personnel working on site.

1.5.1 Health and Safety Training

Tetra Tech personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 of the *Code of Federal Regulations* (29 CFR) Part 1910.120(e). These requirements include (1) 40 hours of formal off-site instruction, (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor, and (3) 8 hours of annual refresher training. Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers the health and safety program, training, personal protective equipment (PPE), and spill containment program requirements and health-hazard monitoring procedures and techniques. At least one member of the field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation Modular," or equivalent.

Before work begins at a specific hazardous site, the following activities will be discussed and reviewed:

- Names of personnel and alternates responsible for health and safety at a hazardous waste project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances
- Contents of the site-specific health and safety plan (HASP)

1.5.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites. Training will meet OSHA requirements defined in 29 CFR Part 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to Tetra Tech.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the "Daily Tailgate Safety Meeting Form" (Appendix D) before they conduct on-site work. The topics described in Section 1.5.1 are covered in the safety briefing. The briefing is conducted by Tetra Tech's on-site health and safety officer or other qualified person.

Subcontractors are responsible for conducting their own safety briefings. Tetra Tech personnel may audit these briefings.

1.6 DOCUMENTS AND RECORDS

Documentation is critical for evaluating the success of any environmental data collection activity. This section discusses the requirements for documenting field activities and preparing laboratory data packages and describes reports that will be generated as a result of this project.

1.6.1 Field Documentation

Complete and accurate documentation is essential to demonstrate that field measurements and sampling procedures are carried out as described in the SAP. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the job number, the site name, and the names of subcontractors, the service client, and the project manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to the field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken
- List of equipment models used and calibration results
- Sample collection information

All information will be entered with a ballpoint pen with waterproof ink. Every line of the logbook will be used. If a subject changes and an additional blank space is necessary to make the new subject title standout, one line will be skipped before the new subject begins. A new page will begin each day's notes, and a diagonal line will be drawn on any blank spaces of four lines or more to prevent unauthorized entries. A single line through the entry, with an initialed and dated, will be made to make corrections.

The field team will also use the field forms presented in Appendix D.

1.6.2 Summary Data Package

The subcontracted laboratory will prepare summary data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statements of work (SOW) (EPA 1999a, 2000a). The summary data package will consist of a case narrative, copies of all associated chain-of-custody (COC) forms, sample results, and quality assurance (QA) and QC summaries. The case narrative will include the following information:

- Subcontractor name, project name, job number, project order number, sample delivery group (SDG) number, and a table that cross-references client and laboratory sample identification (ID) numbers
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

1.6.3 Full Data Package

When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA CLP SOWs (EPA 1999a, 2000a). Full data packages will contain all of the information from the summary data package and all associated raw data. Table 7 outlines the requirements for the full data package. Full data packages are due to Tetra Tech within 21 days after the last sample in the SDG is received. Unless otherwise requested, the subcontractor will deliver two copies of the full data package on compact disks.

1.6.4 Data Package Format

The subcontracted laboratory will provide electronic data deliverables (EDD) for all analytical results. An automated laboratory information management system (LIMS) must be used to produce the EDDs. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDDs will correspond exactly to the hard-copy data. The data in the laboratory EDDs will be transferred by Tetra Tech into tables in Navy Environmental Data Deliverable (NEDD) format for upload to the Navy's data management and geographic information system, named the Navy Installation Restoration Information Solution (NIRIS).

TABLE 7: REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Requirements for Summary Data Packages – Inorganic Analysis	
Section I	Case Narrative
1.	Case narrative
2.	Copies of nonconformance and corrective action forms
3.	Chain-of-custody forms
4.	Copies of sample receipt notices
5.	Internal tracking documents, as applicable
Section II	Sample Results - Form I for the following:
1.	Environmental sample including dilutions and re-analysis
Section III	QA/QC Summaries - Forms II through XIV for the following:
1.	Initial and continuing calibration verifications (Form II)
2.	PRRL standard (Form II)
3.	Detection limit standard (Form II-Z)
4.	Method blanks, continuing calibration blanks, and preparation blanks (Form III)
5.	ICP interference-check samples (Form IV)
6.	MS and post-digestion spikes (Forms V and V-Z)
7.	Sample duplicates (Form VI)
8.	LCSs (Form VII)
9.	Method of standard additions (Form VIII)
10.	ICP serial dilution (Form IX)
11.	IDL (Form X)
12.	ICP interelement correction factors (Form XI)
13.	ICP linear working range (Form XII)
Sections I, II, III	Summary Package
Section IV	Instrument Raw Data - Sequential measurement readout records for ICP, graphite furnace atomic absorption, flame atomic absorption, cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information:
1.	Environmental samples, including dilutions and reanalysis
2.	Initial calibration

TABLE 7: REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Requirements for Summary Data Packages – Inorganic Analysis

<u>Section IV (Continued)</u> Instrument Raw Data - Sequential measurement readout records for ICP, graphite furnace atomic absorption, flame atomic absorption, cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information:

3. Initial and continuing calibration verifications
4. Detection limit standards
5. Method blanks, continuing calibration blanks, and preparation blanks
6. ICP interference check samples
7. MS and post-digestion spikes
8. Sample duplicates
9. LCSs
10. Method of standard additions
11. ICP serial dilution

<u>Section V</u> Other Raw Data

1. Percent moisture for soil samples
2. Sample digestion, distillation, and preparation logs, as necessary
3. Instrument analysis log for each instrument used
4. Standard preparation logs, including initial and final concentrations for each standard used
5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for soil sample results

Notes:

GPC	Gel permeation chromatography
ICP	Inductively coupled plasma
IDL	Instrument detection limit
LCS	Laboratory control sample
MS	Matrix spike
MSD	Matrix spike duplicate
PRRL	Project-required reporting limits
QA/QC	Quality assurance/quality control
RPD	Relative percent difference
SAP	Sampling and analysis plan
SVOC	Semivolatile organic compound
TIC	Tentatively identified compound
VOC	Volatile organic compound

Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the COC form
- Method and instrument blank and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MSs, MSDs, blank spikes, and LCSs, as applicable
- Matrix duplicate results reported for the SDG
- All reanalysis, re-extractions, or dilutions reported for the SDG, including those associated with samples and the specified laboratory QC samples

Electronic and hard-copy data must be retained for a minimum of 3 and 10 years, respectively, after final data have been submitted. The subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained in an electronic data archival system.

1.6.5 Reports Generated

The results of the additional sampling will be summarized in a data package that will be submitted to the regulatory agencies. Data from the off-site investigation and Mt. Diablo/Seal Creek investigation will also be included in a remedial investigation (RI) for Site 22.

2.0 DATA GENERATION AND ACQUISITION

This section describes the requirements for the following data generation and acquisition:

- Sampling Process Design (Section 2.1)
- Field Methods (Section 2.2)
- Sample Handling and Custody (Section 2.3)
- Analytical Methods (Section 2.4)
- Quality Control (Section 2.5)
- Equipment Testing, Inspection, and Maintenance (Section 2.6)
- Instrument Calibration and Frequency (Section 2.7)
- Inspection and Acceptance of Supplies and Consumables (Section 2.8)
- Nondirect Measurements (Section 2.9)
- Data Management (Section 2.10)

2.1 SAMPLING PROCESS DESIGN

The Navy will collect surface soil or sediment samples from the off-site areas, Mount Diablo/Seal Creek, the low-lying areas of the western portion of Site 22, the southeastern portion of Site 22 within Clayton Canal, and Magazine Areas A, B, C, and D. The work will include:

- Collect 20 surface soil samples (0 to 0.5 foot bgs) for analysis of arsenic from the off-site properties (Figure 4). Surface soil samples will be collected along a transect that will extend from sampling locations along the fence line at two distances from the fence line (2 feet and 10.5 feet). Distances are based on the estimated spray radius for the application of herbicides (see Table 4). If access is denied or for any other reason it is not possible to collect a sample along any of the existing transects, an alternate transect will be selected. Alternate transects will be designated using a random distance and direction (north or south) from the existing transect. The random distance will be limited to between 100 and 800 feet, to assure at least 100 feet of separation between any two transects (the existing transects are spaced approximately 900 feet apart). If samples cannot be collected at the first alternate location, then a second alternate (and so forth) will be selected.

- Collect a total of 30 surface soil samples (0 to 0.5 foot bgs) for arsenic analysis at the other Inland Area Magazines (Magazines A through D) (Figure 3).

- Collect surface sediment samples (0 to 0.5 feet bgs) from nine locations (7SHSD001 through 7SHSD009) along Mount Diablo/Seal Creek (Figure 7). One location will be upstream of Site 22; the other locations are depositional areas the regulators and Navy identified during the September 2005 site visit. One sample will be collected at each location, with the exception of locations 7SHSD007 through 7SHSD009, where three samples will be collected at each location. Samples are referred to as sediment, but the creek is ephemeral and is likely to be dry when samples are collected.

- Collect sediment samples (0 to 0.5 feet bgs) from six locations (7SHSD010 through 7SHSD0015) in the western portion of the Site 22 Magazine Area (Figure 7).

- Collect sediment samples (0 to 0.5 feet bgs) from three locations (7SHSD016 through 7SHSD018) in the southeastern portion of Site 22 Magazine Area with the abandoned Clayton Canal (Figure 7).

- Collect up to four surface samples (0 to 0.5 feet bgs) from previous Site 22 Magazine Area sample locations (7SHSB121 and 7SHSB153) and proposed off-site sampling locations 7SHSB185 and 7SHSB189) to assess the bioavailability of arsenic in soil.

- Survey sample locations using a global positioning system (GPS).

Sampling locations and analyses are listed in Table 8.

TABLE 8: SURFACE SOIL SAMPLING LOCATIONS, ANALYSES, AND RATIONALE

Final SAP, Additional Investigation at Site 22 - Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Sampling Location	Sample ID Number	Media (Sampling Depth)	Analyses[1]	Rationale
Off-Site Sampling Area				
7SHSB175	02922SB060	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB176	02922SB061	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB177	02922SB062	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB178	02922SB063	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB179	02922SB064	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB180	02922SB065	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB181	02922SB066	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB182	02922SB067	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB183	02922SB068	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB184	02922SB069	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB185	02922SB070	Soil (0 to 0.5 foot bgs)	Arsenic/ Bioavailability	Assess whether off-site areas have been affected from herbicide spraying at Site22/ Assess bioavailability of arsenic detected
7SHSB186	02922SB071	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22

TABLE 8: SURFACE SOIL SAMPLING LOCATIONS, ANALYSES, AND RATIONALE (Continued)
Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Sampling Location	Sample ID Number	Media (Sampling Depth)	Analyses[1]	Rationale
Off-Site Sampling Area (Continued)				
7SHSB187	02922SB072	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB188	02922SB073	Soil (0 to 0.5 foot bgs)	Arsenic/ Bioavailabilty	Assess whether off-site areas have been affected from herbicide spraying at Site22/ Assess bioavailability of arsenic detected
7SHSB189	02922SB074	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB190	02922SB075	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB191	02922SB076	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB192	02922SB077	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB193	02922SB078	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
7SHSB194	02922SB079	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether off-site areas have been affected from herbicide spraying at Site 22
Mount Diablo/Seal Creek				
7SHSD001	02922SD001	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek
7SHSD002	02922SD002	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Seal Mount Diablo/Creek
7SHSD003	02922SD003	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek
7SHSD004	02922SD004	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek
7SHSD005	02922SD005	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek

TABLE 8: SURFACE SOIL SAMPLING LOCATIONS, ANALYSES, AND RATIONALE (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Sampling Location	Sample ID Number	Media (Sampling Depth)	Analyses[1]	Rationale
Mount Diablo/Seal Creek (Continued)				
7SHSD006	02922SD006	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek
7SHSD007	02922SD007A through C	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek
7SHSD008	02922SD008A through C	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek
7SHSD009	02922SD009A through C	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in Mount Diablo/Seal Creek
Western Portion of Site 22				
7SHSD010	02922SD010	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in low-lying area of Site 22 (Drainage Areas A and B)
7SHSD011	02922SD011	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in low-lying area of Site 22 (Drainage Areas A and B)
7SHSD012	02922SD012	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in low-lying area of Site 22 (Drainage Areas A and B)
7SHSD013	02922SD013	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in low-lying area of Site 22 (Drainage Areas A and B)
7SHSD014	02922SD014	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in low-lying area of Site 22 (Drainage Areas A and B)
7SHSD015	02922SD015	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in low-lying area of Site 22 (Drainage Areas A and B)
Southeastern Portion of Site 22 (within Clayton Canal)				
7SHSD016	02922SD016	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in the abandoned Clayton Canal
7SHSD017	02922SD017	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in the abandoned Clayton Canal
7SHSD018	02922SD018	Sediment (0 to 0.5 foot bgs)	Arsenic	Assess arsenic concentrations in the abandoned Clayton Canal

TABLE 8: SURFACE SOIL SAMPLING LOCATIONS, ANALYSES, AND RATIONALE (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Sampling Location	Sample ID Number	Media (Sampling Depth)	Analyses[1]	Rationale
Inland Area Magazines				
Magazine Area A				
MAGASB001	029MAGA001	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether Inland Area magazines have been affected from arsenic herbicide application
MAGASB002	029MAGA002	Soil (0 to 0.5 foot bgs)		
MAGASB003	029MAGA003	Soil (0 to 0.5 foot bgs)		
MAGASB004	029MAGA004	Soil (0 to 0.5 foot bgs)		
MAGASB005	029MAGA005	Soil (0 to 0.5 foot bgs)		
MAGASB006	029MAGA006	Soil (0 to 0.5 foot bgs)		
MAGASB007	029MAGA007	Soil (0 to 0.5 foot bgs)		
MAGASB008	029MAGA008	Soil (0 to 0.5 foot bgs)		
Magazine Area B				
MAGBSB001	029MAGB001	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether Inland Area magazines have been affected from arsenic herbicide application
MAGBSB002	029MAGB002	Soil (0 to 0.5 foot bgs)		
MAGBSB003	029MAGB003	Soil (0 to 0.5 foot bgs)		
MAGBSB004	029MAGB004	Soil (0 to 0.5 foot bgs)		
Magazine Area C				
MAGCSB001	029MAGC001	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether Inland Area magazines have been affected from arsenic herbicide application
MAGCSB002	029MAGC002	Soil (0 to 0.5 foot bgs)		
MAGCSB003	029MAGC003	Soil (0 to 0.5 foot bgs)		
MAGCSB004	029MAGC004	Soil (0 to 0.5 foot bgs)		
MAGCSB005	029MAGC005	Soil (0 to 0.5 foot bgs)		
MAGCSB006	029MAGC006	Soil (0 to 0.5 foot bgs)		
MAGCSB007	029MAGC007	Soil (0 to 0.5 foot bgs)		
MAGCSB008	029MAGC008	Soil (0 to 0.5 foot bgs)		

TABLE 8: SURFACE SOIL SAMPLING LOCATIONS, ANALYSES, AND RATIONALE (Continued)

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Sampling Location	Sample ID Number	Media (Sampling Depth)	Analyses[1]	Rationale
Magazine Area D				
MAGDSB001	029MAGD001	Soil (0 to 0.5 foot bgs)	Arsenic	Assess whether Inland Area magazines have been affected from arsenic herbicide application
MAGDSB002	029MAGD002	Soil (0 to 0.5 foot bgs)		
MAGDSB003	029MAGD003	Soil (0 to 0.5 foot bgs)		
MAGDSB004	029MAGD004	Soil (0 to 0.5 foot bgs)		
MAGDSB005	029MAGD005	Soil (0 to 0.5 foot bgs)		
MAGDSB006	029MAGD006	Soil (0 to 0.5 foot bgs)		
MAGDSB007	029MAGD007	Soil (0 to 0.5 foot bgs)		
MAGDSB008	029MAGD008	Soil (0 to 0.5 foot bgs)		
MAGDSB009	029MAGD009	Soil (0 to 0.5 foot bgs)		
MAGDSB010	029MAGD010	Soil (0 to 0.5 foot bgs)		
Site 22 Inland Area Magazine				
7SHSB121	02922SB080	Soil (0 to 0.5 foot bgs)	Bioavailability	Assess bioavailability of arsenic detected at previous surface soil samples at Site 22
7SHBS153	02922SB081	Soil (0 to 0.5 foot bgs)	Bioavailability	Assess bioavailability of arsenic detected at previous surface soil samples at Site 22

Notes:

1 Arsenic by EPA Method 6020 SW-846/ Arsenic Bioavailablity by Naval Facilities Engineering Service Center *In Vitro* Method

ft bgs Feet below ground surface
ID Identification
PCB Polychlorinated biphenyls
QA/QC Quality assurance and quality control
SAP Sampling and Analysis Plan
VOC Volatile organic compounds

2.2 FIELD METHODS

This section discusses the field methods that will be used during this investigation. The individual tasks are organized and described in this section as follows:

- Surface Soil Sampling (Section 2.2.1)
- Land Surveying (Section 2.2.2)

2.2.1 Surface Soil Sampling

Sample collection points will be located using a Trimble Pathfinder Pro XR or equivalent GPS. A wooden stake will be pre-labeled with each sample location to identify the surveyed point. The wooden stake will be removed prior to sampling.

Surface soil samples will be collected using disposable polyethylene trowels. The trowel will have a scooped blade 4 to 8 inches long and 2 to 3 inches wide with a handle. Prior to sampling, surface vegetation will be removed using the trowel. The vegetation and any excess soil removed during sampling will be placed on plastic sheeting until the sampling is completed. Soil will be removed directly beneath the area of removed vegetation with the trowel from 0.0 to 0.5 foot bgs. Soil will be transferred directly from the trowel to the sample container, a 4-ounce jar. The sample container will then be labeled as discussed in Section 2.3.2 and placed in a refrigerated cooler for storage before it is shipped to the laboratory.

Soil boreholes will be filled with topsoil, and vegetation removed will be replaced. Surface cover at each location will be noted in a field log. Special care will be taken in off base sampling to ensure that plants and property are not damaged.

2.2.1.1 Equipment Decontamination

Equipment will not need to be decontaminated, as disposable polyethylene trowels will be used to collect samples.

2.2.1.2 Management of Investigation-Derived Waste

IDW generated during this investigation will include disposable trowels, personal protective gear and general trash. IDW will be placed in 55-gallon drums approved by the U.S. Department of Transportation, and will be labeled with information about their contents, the source of their contents, the generation date, and the Navy point of contact.

2.2.1.3 *Sample Containers, Preservation, and Holding Times*

Table 9 presents the type of sample container to be used for each analysis, the sample volumes required, the preservation requirements, and the maximum holding times for samples before extraction and analysis.

TABLE 9: SAMPLE CONTAINER, PRESERVATIVE, AND HOLDING TIME REQUIREMENTS
Final SAP, Additional Investigation at Site 22 - Southwest Fence Line and Seal Creek, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Parameter	Method Number	Sample Container[a]	Preservation	Holding Time
Soil				
Arsenic	EPA 6020 SW-846	Acetate sleeve or 4 ounce glass jar	Cool 4 ± 2ºC	6 months
Arsenic	NFESC *In Vitro* method[b]	Acetate sleeve or 4 ounce glass jar	Cool 4 ± 2ºC	6 months

Notes:

a All glass containers will be equipped with plastic caps with Teflon-lined closures.

b NFESC User's Guide, UG-2041-ENV "Guide to Incorporating Bioavailability Adjustments into Human Health and Ecological Risk Assessments at U.S. Navy and Marine Corps Facilities", Part 2, Appendix D. July 2000.

EPA U.S. Environmental Protection Agency

NFESC Naval Facilities Engineering Service Center

SAP Sampling and analysis plan

2.2.2 Surveying

As discussed in Section 2.2.1, prior to sampling, soil sample locations will be surveyed using a Trimble Pathfinder Pro XR or equivalent GPS instrument. Horizontal coordinates will be measured to a target accuracy of 1 meter or better, as permitted by field conditions.

2.3 SAMPLE HANDLING AND CUSTODY

This section describes sample handling procedures, including sample identification, labeling, and documentation; COC records; and shipping procedures.

2.3.1 Sample Identification

A unique sample ID number will be assigned to each sample collected during this project. The sample ID numbering system is designed to be compatible with a computerized data management system that includes previous results for samples collected at Detachment Concord. The sample numbering system allows each sample to be uniquely identified and provides a means of tracking the sample from collection through analysis. The numbering system indicates the contract number, site name, sampling type, and the sequential sample number. The numbering scheme is illustrated below.

Contract Number	D029		
Site	MAGA	=	Magazine Area A
Sample Type	SB	=	Surface soil sample from boring
	SD	=	Sediment sample from Mount Diablo/Seal Creek
Sample Number	001	=	Sample numbers will be sequential

For example, the first soil sample collected during this investigation from Magazine Area A will be identified as MAGASB001. Table 8 lists the sample ID numbers for this investigation.

2.3.2 Sample Labels

A sample label will be affixed to all sample containers. The label will be completed with the following information written in indelible ink:

- Project name and location
- Sample ID number
- Date and time of sample collection
- Preservative used
- Sample collector's initials
- Analysis required

After each sample is labeled, it will be refrigerated or placed in a cooler that contains ice to maintain the sample temperature at 4 °C, plus or minus 2 °C.

2.3.3 Sample Documentation

Sample documentation is important to ensure proper identification of the samples. Field personnel will use the following guidelines for maintaining field documentation:

- Documentation will be completed in permanent black ink
- All entries will be legible
- Errors will be crossed out with a single line, and the lineout will be dated and initialed
- Serialized documents will be maintained by Tetra Tech and referenced in the site logbook
- Unused portions of pages will be crossed out, and each page will be signed and dated

2.3.4 Chain-of-Custody Procedures

Field personnel will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal so the sample cannot be reached without breaking the seal.

COC procedures provide an accurate written record that traces the possession of individual samples from the time they are collected in the field to the time they are accepted at the laboratory. The COC form (Appendix D) will be used to document all samples collected and the analysis requested for each sample. Field personnel will record the following information on the COC form:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample ID number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Air bill number (if applicable)
- Project contact and phone number

Unused lines on the COC form will be crossed out. Field personnel will sign all COC forms that are initiated in the field. The COC form will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed air bills will serve as evidence of custody transfer between field personnel and the courier and between the courier and the laboratory. Copies of the COC form and the air bill will be retained and filed by field personnel before the containers are shipped.

Laboratory COC forms are used when samples are received and continue to be used until samples are discarded. Laboratories analyzing samples under the Navy contract must follow custody procedures as stringent as are required by EPA's CLP SOWs (EPA 1999a, 2000a). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons who delivered the samples; the date and time the sample is received; the condition of the sample at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks); the sample ID numbers; and any unique laboratory ID numbers for the samples. This information should be entered into a computerized LIMS. When the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples that require special handling, including samples that are heat- or light-sensitive, radioactive, or exhibit other unusual physical characteristics, will be properly stored and maintained before analysis.

2.3.5 Sample Shipment Procedures

The following procedures will be implemented when samples collected during this investigation are shipped to the fixed laboratory:

- The cooler will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment. Enough ice will be added to maintain the sample temperature of below 4 °C, plus or minus 2 °C.

- The COC forms will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.

- The cooler will be closed and taped shut with strapping tape around both ends. If the cooler has a drain, it will be taped shut both inside and outside of the cooler.

- Signed and dated custody seals will be placed on all sample containers and on the front and side of each cooler. If VOC vials are used, the vials will be placed in a plastic bag and the custody seal will be placed on the bag. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The COC form will be transported within the taped sealed cooler. When the cooler is received at the analytical laboratory, laboratory personnel will open the cooler and sign the COC form to document transfer of samples.

Multiple coolers may be sent in one shipment to the laboratory. The outside of the coolers will be marked to indicate the number of coolers in the shipment.

2.4 ANALYTICAL METHODS

Table 9 presents the analytical methods that will be used to analyze samples collected during this investigation. Appendix C presents the method precision and accuracy goals for the samples. Appendix E provides a comparison of the PRRLs and the criteria used to evaluate the data.

In addition, bioavailability of arsenic will be assessed. Samples are dried and sieved to <250 um. A leaching procedure is then employed (NFESC 2000). Arsenic concentrations are then measured using SW-846 method 6010B (EPA 1996). The bioavailability of arsenic is calculated in the following manner:

$$\text{Bioavailability (\%)} = \frac{(\text{concentration } \textit{in vitro} \text{ extract, mg/L})\ (0.1 \text{ liter – fluid})}{(\text{concentration in solid, mg/kg})\ (0.001 \text{ kg – soil})} \times 100$$

Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and QA/QC requirements are discussed below.

2.4.1 Selection of Fixed Laboratories

Fixed laboratories for this investigation will be selected from a list of prequalified laboratories developed by Tetra Tech to support Navy contracts. Prequalification streamlines laboratory selection by reducing the need to compile and review detailed bid and qualification packages for each individual investigation. Prequalification also improves flexibility in the program by allowing the analysis to be directed to various laboratories with available capacity at the time samples are collected.

The Tetra Tech team's laboratory prequalification and selection process relies on (1) a standard procedure to evaluate and prequalify laboratories for work under the contract, and (2) the Tetra Tech's SOW for Navy contracts (Tetra Tech 2002), a contractual document that specifies standard requirements for analyses that are routinely conducted. The Tetra Tech team establishes a basic ordering agreement that incorporates and enforces the laboratory SOW with each prequalified laboratory. Individual purchase orders can then be written for specific investigations. These aspects of laboratory selection are further described in the sections below, along with Tetra Tech's procedures for selecting laboratories when the laboratory SOW does not specifically address project-specific analytical methods or QC requirements.

2.4.1.1 Laboratory Evaluation and Prequalification

Laboratories that support the Navy both directly or through subcontracts are evaluated and approved for Navy use by the Naval Facilities Engineering Service Center (NFESC). Laboratories that support the Navy contracts have been selected from the list of laboratories approved by NFESC and evaluated by Tetra Tech to assure that the laboratory can meet the technical requirements of the laboratory SOW and produce data of acceptable quality. The laboratories are evaluated in accordance with the NFESC *Installation Restoration Chemical Data Quality Manual* (NFESC 1999). The laboratory evaluation includes the following elements:

- **Certification and Approval.** Laboratories must be currently certified by the California Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP) for analysis of hazardous materials for each method specified. Laboratories must also have or obtain similar approval from NFESC. The DHS ELAP certification and NFESC approval must be obtained before the laboratory begins work. The laboratory that will be assigned the *in vitro* procedure to determine a bioavailability value for arsenic is not California certified. Appropriate QA/QC procedures are followed for all tests, however, to ensure the highest quality data.

- **Performance Evaluation (PE) Samples.** Each laboratory must initially and yearly demonstrate its ability to satisfactorily analyze single-blind PE samples for all analytical services it will provide under Navy contracts. At its discretion, Tetra Tech may submit one or more double-blind PE samples at Tetra Tech's cost. When the results for the PE sample are deficient, the laboratory must correct any problems and analyze (at its own cost) a subsequent round of PE samples for the deficient analysis.

- **Audits.** Laboratories must initially and yearly demonstrate their qualifications by submitting to one or more audits by Tetra Tech. The audits may consist of (1) an on-site review of laboratory facilities, personnel, documentation, and procedures, or (2) an off-site review of hard copy and electronic deliverables or magnetic tapes. When deficiencies are identified, the laboratory must correct the problem and provide Tetra Tech with a written summary of the corrective action that was taken.

2.4.1.2 Laboratory Statement of Work

The laboratory SOW establishes standard requirements for the analytical methods that are most commonly used under Navy contracts. The laboratory SOW specifies standard method-specific target analyte lists and PRRLs, QC samples and associated control limits, calibration requirements, and miscellaneous method performance requirements. The laboratory SOW also specifies standard data package requirements, EDD formats, data qualifiers, and delivery schedules. In addition, the laboratory SOW outlines support services (such as providing sample containers, trip blanks, temperature blanks, sample coolers, and COC forms and seals) that are expected of laboratories. The laboratory SOW incorporates Navy QA policy, as well as applicable EPA and state QA guidelines, as appropriate.

Tetra Tech's laboratory SOW is based on EPA CLP methods for VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. The laboratory SOW also addresses frequently used non-CLP methods for a variety of organic, inorganic, and physical parameters. Non-CLP methods include the methods published by EPA in SW-846 (EPA 1996) and in "Methods for Chemical Analysis of Water and Waste" (MCAWW) (EPA 1983); American Society for Testing and Materials methods; and others published by the American Public Health Association (APHA), American Water Works Association, and Water Pollution Control Federation in *Standard Methods for the Examination of Water and Waste Water* (APHA 1992). Laboratories on Tetra Tech's approved laboratory list can elect to provide all or a portion of the analytical services specified in the laboratory SOW.

As noted above, the laboratory SOW is incorporated into all laboratory subcontracts established for analytical services that support Navy projects. Thus, the prequalified laboratories commit to meeting the requirements in the laboratory SOW during the contracting process before they receive samples. Tetra Tech regularly reviews and revises the laboratory SOW to incorporate new methods and requirements, modifications or updates to existing methods, changes in Navy QA policy or regulatory requirements, and any other necessary corrections or revisions.

2.4.1.3 Laboratory Selection and Oversight

After project-specific analytical and QA/QC requirements are identified and documented in the SAP, Tetra Tech's analytical coordinator works closely with Tetra Tech's procurement specialist to select a laboratory that can meet these requirements. When project-specific analytical and QC requirements are consistent with Tetra Tech's laboratory SOW, the analytical coordinator identifies one or more prequalified subcontractor laboratories that are capable of carrying out the work. As part of this process, the analytical coordinator typically contacts the laboratories to discuss the analytical requirements and project schedule. The analytical coordinator then forwards the name of the recommended laboratory (or laboratories) to the procurement specialist, who issues a purchase order for the work. When analytical requirements are consistent with Tetra Tech's laboratory SOW and multiple prequalified laboratories are capable of performing the work, a specific laboratory is selected based on laboratory workload and project schedule considerations.

Tetra Tech follows a similar procedure when project-specific analytical and QC requirements are nonstandard and differ from those specified in Tetra Tech's laboratory SOW. The analytical coordinator contacts analytical laboratories, beginning with any on the Tetra Tech team's prequalified list, to discuss the analytical and QA/QC requirements in the SAP and to assess the laboratories' ability to meet the requirements. In many cases, Tetra Tech works cooperatively with analytical laboratories to develop and refine appropriate QC requirements for nonstandard analyses or matrices.

If the analytical coordinator is unable to identify one or more prequalified laboratories that can accept the work, additional laboratories are contacted. In general, the additional laboratories must be evaluated as described in Section 2.4.1.1 before they will be allowed to analyze any samples, although some steps in the evaluation may be waived for certain investigations and circumstances (for example, unusual analytes, urgent project needs, experimental methods, mobile laboratories, or on-site screening analyses). After additional laboratories have been identified, the analytical coordinator forwards their names to the procurement specialist. The procurement specialist prepares a solicitation package, including the project-specific analytical and QC requirements, and submits the package to the laboratories. The procurement specialist, in cooperation with the analytical coordinator and project manager, then evaluates the proposals that are received and selects a laboratory that meets the requirements and provides the best value to the Navy and Tetra Tech. Finally, the procurement specialist issues a purchase order to the selected laboratory that incorporates the project-specific analytical and QA/QC requirements.

After a laboratory has been selected, the analytical coordinator holds a kickoff meeting with the laboratory project manager. The kickoff meeting is held regardless of whether project-specific analytical and QA/QC requirements are consistent with the Tetra Tech's laboratory SOW or are outside the SOW. Tetra Tech's project manager, procurement specialist, and other key project and laboratory staff may be involved in this meeting. The kickoff meeting includes a review of analytical and QC requirements in the SAP, the project schedule, and any other logistical support that the laboratory will be expected to provide.

2.4.2 Project Analytical Requirements

One or more prequalified subcontractor laboratories will analyze the soil and groundwater samples for this investigation. The laboratories will be selected before the field program begins based on their ability to meet the project analytical and QC requirements, as well as their ability to meet the project schedule. Most of the analytical methods for the project are standard methods that are described in Tetra Tech's laboratory SOW. In addition, a laboratory specializing in *in vitro* bioavailability (physiologically-based extractions) will be procured (NFESC 2000).

This SAP documents project-specific QC requirements for the analytical methods selected. Requirements for sample volume, preservation, and holding times are specified in Table 9. Requirements for laboratory QC samples are described in Table 7 and in Section 2.5. Appendix C includes project-specific precision and accuracy goals for the methods. Finally, Appendix E documents the PRRLs for each method.

2.5 QUALITY CONTROL

Since disposable trowels are used, Tetra Tech will assess the quality of field data through regular collection and analysis of field QC samples. Laboratory QC samples will be analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures are conducted properly and that the quality of the data is known.

2.5.1 Field Quality Control Samples

QC samples are typically collected in the field and analyzed to check sampling and analytical precision, accuracy, and representativeness. This section discusses the types and purposes of field QC samples that will be collected for this investigation. Table 10 summarizes the types and collection frequency of field QC samples and laboratory QC samples.

TABLE 10: FIELD AND LABORATORY QC SAMPLES
Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Sample Type	Frequency of Analysis
Field QC[a]	
Temperature Blank	One per sample transport container shipped to laboratory
Laboratory QC	
Method Blank	One per 20 samples collected
Reagent Blank	One per batch (NFESC *In Vitro* method only)[b]
Matrix Spike	One per 20 samples collected (SW-846 method only)[c]
Matrix Duplicate	One per 20 samples collected
Laboratory Control Sample	One per 20 samples collected

Notes:

a Disposable sampling equipment will be used. No equipment rinsate blanks, therefore, are proposed.

b EPA. 1996. “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Update III.” OSWER. Washington, DC. December.

c Naval Facilities Engineering Services Center. 2000. “Appendix C: *In vitro* Method for Determination of Lead Bioavailability: Standard Operating Procedure for Stomach Phase Extraction”, NFESC User's Guide, UG-2049-ENV. July.

QC Quality control

SAP Sampling and analysis plan

2.5.1.1 Field Duplicate Samples

Although field duplicate soil samples are sometimes collected as soil samples from adjacent locations, duplicate samples for soil will not be collected for this project, for two reasons. First, these samples cannot be used directly to assess sampling precision because adjacent soil samples incorporate some spatial variability. Furthermore, it is not practical to set QC limits for the RPD of these samples, which precludes their use for QC. Second, while the information on spatial variability that can be obtained from adjacent soil samples may be useful in assessing or implementing remedial options, no objectives relating to these data uses have been identified for this project. Rather, it has been determined that this type of information on spatial variability will be obtained during subsequent investigations at this site, if deemed necessary.

2.5.1.2 Equipment Rinsate Samples

Disposable sampling equipment will be used during this investigation. An equipment rinsate sample, therefore, is not needed.

2.5.1.3 Source Water Blank Samples

Disposable sampling equipment will be used during this investigation. A source water blank sample, therefore, is not needed.

2.5.1.4 Temperature Blanks

A temperature blank demonstrates that the samples have been maintained at the required temperature during transport to the laboratory. A temperature blank originates at the laboratory as a 40-milliliter vial typically used for VOC analysis. The vial is half-filled at the laboratory with tap water and unpreserved. The temperature blanks are clearly marked "TEMPERATURE" and are transported to the site with the empty containers that will be used for sample collection. The temperature blanks are stored at the site until the proposed field samples have been collected. One temperature blank will accompany each sample transport container back to the laboratory. When it arrives at the laboratory, the temperature blank will be used to check the temperature of the transport container. Alternatively, the laboratory may use an infrared thermometer to check the temperature.

2.5.2 Laboratory Quality Control Samples

This section discusses the types of laboratory QC samples that will be used for this investigation. Table 10 summarizes the types and frequency of collection of laboratory QC samples. Appendix E presents project-specific precision and accuracy goals for these samples.

2.5.2.1 Matrix Spike

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. Matrix spikes will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

2.5.2.2 Blanks

Method blanks will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. Reagent blanks will be analyzed once per batch of extraction fluid.

2.5.2.3 Laboratory Control Samples

LCSs, or blank spikes, will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. Laboratory-specific protocols will be followed to evaluate the usability of the data if percent recovery results for the LCS or blank spike are outside of the established goals.

2.5.3 Additional Laboratory Quality Control Procedures

In addition to the analysis of laboratory QC samples, subcontractor laboratories will conduct the QC procedures discussed below.

2.5.3.1 Method Detection Limit Studies

The MDL is the minimum concentration of a compound that can be measured and reported. The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL accounts for sample matrix and preparation. The subcontractor laboratory will demonstrate the MDLs for all analyses (except inorganic analyses) other than metals and physical properties test methods.

MDL studies will be conducted annually for soil matrices, or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than required quantitation limits. The replicates will be extracted and analyzed in the same manner as routine samples. If multiple instruments are used, each will be included in the MDL study. The MDLs reported will be representative of the least sensitive instrument.

2.5.3.2 Sample Quantitation Limits

Sample quantitation limits (SQL), also referred to as practical quantitation limits, are PRRLs adjusted for the characteristics of individual samples. The PRRLs presented in Appendix E are chemical-specific levels that a laboratory should be able to routinely detect and quantitate in a sample matrix. The PRRL is usually defined in the analytical method or in laboratory method documentation. The SQL accounts for changes in preparation and analytical methodology that may alter the ability to detect an analyte, including changes such as use of a smaller sample aliquot or dilution of the sample extract. Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.

2.5.3.3 Control Charts

Control charts document data quality in graphic form for specific method parameters such as surrogate standards and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in determining whether analytical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. Although they are not required, Tetra Tech recommends that subcontractor laboratories maintain control charts for organic and inorganic analyses. At a minimum, method blank surrogate recoveries and blank spike recoveries should be charted for all organic methods. Blank spike recoveries should be charted for inorganic methods. Control charts should be updated monthly.

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

2.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in the equipment manufacturer’s literature or operating manual. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The field team leader (FTL) will be notified of equipment malfunctions so that service can be completed quickly or substitute equipment can be obtained. Unscheduled testing, inspection, and maintenance should be conducted when the condition of equipment is suspect. Any significant problems with field equipment will be reported in the daily field QC report.

2.6.2 Maintenance of Laboratory Equipment

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected for this investigation. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory’s QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures; the frequency and type of maintenance performed; and procedures for documenting maintenance.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Proper instrument calibration is essential to ensure the accuracy of measurements made using field and laboratory equipment. Any calibrations will be recorded on a calibration form (Appendix D) or in a field logbook.

2.8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Tetra Tech project managers have primary responsibility for identifying the types and quantities of supplies and consumables needed to complete Navy projects and are responsible for establishing acceptance criteria for these items.

Supplies and consumables can be received either at the Tetra Tech office or at the site. When supplies are received, the project manager or FTL will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order, and the item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar. Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers" (EPA 1992).

2.9 NONDIRECT MEASUREMENTS

No data for project implementation or decision-making will be obtained from nondirect measurement sources.

2.10 DATA MANAGEMENT

Field and analytical data collected from this project and other environmental investigations at Detachment Concord are critical to site characterization efforts, development of the comprehensive site conceptual model, risk assessments, and selection of remedial actions to protect human health and the environment. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into Tetra Tech's database for Detachment Concord. The database contains data for (1) summarizing observations on contamination and geologic conditions, (2) preparing reports and graphics, (3) using with geographic information systems, and (4) transmitting in an electronic format compatible with NEDTS. The sections below describe Tetra Tech's data tracking procedures, data pathways, and overall data management strategy for Detachment Concord.

2.10.1 Data Tracking Procedures

All data that are generated in support of the Navy program at Detachment Concord are tracked through a database created by Tetra Tech. Information related to the receipt and delivery of samples, project order fulfillment, and invoicing for laboratory and validation tasks is stored in Tetra Tech's program, SAMTRAK. All data are filed according to the project order number.

2.10.2 Data Pathways

Data are generated from three primary pathways at Detachment Concord: data derived from field activities, laboratory analytical data, and validated data. Data from all three pathways must be entered into the Detachment Concord database. Data pathways must be established and well documented to evaluate whether the data are accurately loaded into the database in a timely manner.

Data generated during field activities are recorded using field forms (Appendix D). The analytical coordinator or FTL reviews these forms for completeness and accuracy. Data from the field forms, including the COC form, are entered into SAMTRAK according to the project order number.

Data generated during laboratory analysis are recorded in hard copy and in EDDs after the samples have been analyzed. The laboratory will send the hard copy and EDD records to the analytical coordinator. The analytical coordinator reviews the data deliverable for completeness, accuracy, and format. After the format is approved, electronic data are manipulated and downloaded into the NWS SBD Concord database. Tetra Tech data entry personnel will then update SAMTRAK with the total number of samples received and number of days required to receive the data.

After the data have been validated, the analytical coordinator reviews the data for accuracy. Tetra Tech personnel will then update the NWS SBD Concord database with the appropriate data qualifiers. SAMTRAK is also updated to record associated laboratory and data validation costs.

2.10.3 Data Management Strategy

Tetra Tech's short- and mid-term data management strategies require that the database for Detachment Concord be updated monthly. The data consist of chemical and field data from Navy contractors, which is entered into an Oracle (Version 7.3) database. The Oracle database will be used to generate reports using computer-aided design and contouring software. In accordance with the revised Navy Environmental Work Instruction #6, all electronic data from this database will also be submitted to the Navy in the Naval Electronic Data Deliverable (NEDD) format.

To satisfy long-term data management goals, the data will be loaded into Tetra Tech's database for storage, further manipulation, and retrieval after laboratory and field reports are reviewed and validated. The database will be used to provide data for chemical and geologic analysis and for preparing reports and graphic representations of the data. Additional data acquired from field activities are recorded on field forms (Appendix D) that are reviewed for completeness and accuracy by the analytical coordinator or FTL. Hard copies of forms, data, and COC forms are filed in a secure storage area according to project and document control numbers. Laboratory data packages and reports will be archived at Tetra Tech or Navy offices. Laboratories that generated the data will archive hard-copy data for a minimum of 10 years.

3.0 ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting the assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to Tetra Tech and Navy management.

3.1 Assessment and Response Actions

Tetra Tech and the Navy will oversee collection of environmental data using the assessment and audit activities described below. Any problems encountered during an assessment of field investigation or laboratory activities will require appropriate corrective action to ensure that the problems are resolved. This section describes the types of assessments that may be completed, Tetra Tech and Navy responsibilities for conducting the assessments, and corrective action procedures to address problems identified during an assessment.

3.1.1 Field Assessments

Tetra Tech conducts field technical systems audits (TSA) on selected Navy projects to support data quality and encourage continuous improvement in the field systems that involve environmental data collection. The Tetra Tech QA program manager selects projects for field TSAs quarterly based on available resources and the relative significance of the field sampling effort. The assessor will use personnel interviews, direct observations, and reviews of project-specific documentation during the field TSA to evaluate and document whether procedures specified in the approved SAP are being implemented. Specific items that may be observed during the TSA include:

- Availability of approved project plans, such as the SAP and HASP
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling, and shipping procedures
- Sampling equipment decontamination
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)

During the TSA, the Tetra Tech assessor will verbally communicate any significant deficiencies to the FTL for immediate correction. These and all other observations and comments will be documented in a TSA report. The TSA report will be issued to Tetra Tech's project manager, the FTL, program QA manager, and project QA officer in e-mail format within 7 days after the TSA is completed.

Tetra Tech's program QA manager determines the timing and duration of TSAs. Generally, TSAs are conducted early in the project so that any quality issues can be resolved before large amounts of data are collected.

The Navy QA officer may independently conduct a field assessment of any Tetra Tech project. Items reviewed by the Navy QA officer during a field assessment may be similar to those described above.

3.1.2 Laboratory Assessments

As described in Section 2.4.1, NFESC assesses all laboratories before they are allowed to analyze samples under Navy contracts. Tetra Tech also conducts a pre-award assessment of each laboratory before it is entered on the approved list for work under the Navy contracts (Appendix F). These assessments include (1) reviews of laboratory certifications, (2) initial and annual demonstrations of the laboratory's ability to satisfactorily analyze single-blind PE samples, and (3) laboratory audits. Laboratory audits may consist of an on-site review of laboratory facilities, personnel, documentation, and procedures or an off-site evaluation of the ability of the laboratory's data management system to meet contract requirements. Tetra Tech also conducts an assessment when an approved laboratory has been selected for nonroutine analysis or when a laboratory that is not on the approved list must be used.

Tetra Tech will conduct a TSA of the laboratory selected for this project after the laboratory receives and begins processing samples. This TSA will review the project-specific implementation of the methods specified in this SAP and ensure that appropriate QC procedures are being implemented in association with these methods.

The Navy may audit any laboratory that will analyze samples on this project. The Navy QA officer will determine the need for these audits and typically will conduct the audits before samples are submitted to the laboratory for analysis.

3.1.3 Assessment Responsibilities

Tetra Tech personnel who conduct assessments will be independent of the activity evaluated. Tetra Tech's program QA manager will select the appropriate personnel to conduct each assessment and will assign them responsibilities and deadlines for completing the assessment. These personnel may include the program QA manager, project QA officer, or senior technical staff with relevant expertise and experience in assessment activities.

When an assessment is planned, Tetra Tech's program QA manager selects a lead assessor who is responsible for:

- Selecting and preparing the assessment team
- Preparing an assessment plan
- Coordinating and scheduling the assessment with the project team, subcontractor, or other organization being evaluated
- Participating in the assessment
- Coordinating preparation and issuance of assessment reports and corrective action request forms
- Evaluating responses and resulting corrective actions

After a TSA is completed, the lead assessor will submit an audit report to Tetra Tech's QA manger, project manager, and project QA officer; other personnel may be included in the distribution as appropriate. Assessment findings will also be included in the QC summary report (QCSR) for the project (Section 3.2.3).

The Navy QA officer is responsible for coordinating all audits that may be conducted by Navy personnel under this project. Audit preparation, completion, and reporting responsibilities for Navy auditors would be similar to those described above.

3.1.4 Field Corrective Action Procedures

Field corrective action procedures will depend on the type and severity of the finding. Tetra Tech classifies assessment findings as either deficiencies or observations. Deficiencies are findings that may significantly affect data quality and that will require corrective action. Observations are findings that do not directly affect data quality, but are suggestions for consideration and review.

Project teams are required to respond to deficiencies identified in TSA reports. The project manager, FTL, and project QA officer will discuss the deficiencies and the appropriate steps to resolve each deficiency by:

- Determining when and how the problem developed
- Assigning responsibility for problem investigation and documentation
- Selecting the corrective action to eliminate the problem
- Developing a schedule for completing the corrective action
- Assigning responsibility for implementing the corrective action
- Documenting and verifying that the corrective action has eliminated the problem
- Notifying the Navy of the problem and the corrective action taken

In responding to the TSA report, the project team will briefly describe each deficiency, the proposed corrective action, the individual responsible for selecting and implementing the corrective action, and the completion dates for each corrective action. The project QA officer will use a status report to monitor all corrective actions.

Tetra Tech's program QA manager is responsible for reviewing proposed corrective actions and verifying that they have been effectively implemented. The program QA manager can require data acquisition to be limited or discontinued until the corrective action is complete and a deficiency is eliminated. The program QA manager can also request reanalysis of any or all samples and review of all data acquired since the system was last in control.

3.1.5 Laboratory Corrective Action Procedures

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs: (1) control limits are exceeded, (2) method QC requirements are not met, or (3) sample holding times are exceeded. The laboratory will report out-of-control situations to the Tetra Tech analytical coordinator within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the Tetra Tech analytical coordinator. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

3.2 Reports to Management

Effective management of environmental data collection requires (1) timely assessment and review of all activities, and (2) open communication, interaction, and feedback among all project participants. Tetra Tech will use the reports described below to address any project-specific quality issues and to facilitate timely communication of these issues.

3.2.1 Daily Progress Reports

Tetra Tech will prepare a daily progress report to summarize activities throughout the field investigation. This report will describe sampling and field measurements, equipment used, Tetra Tech and subcontractor personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the SAP, and explanations for the deviations. The daily progress report is prepared by the FTL and submitted to the project manager and to the Navy remedial project manager (RPM), if requested. The content of the daily reports will be summarized and included in the final report submitted for the field investigation.

3.2.2 Project Monthly Status Report

The Tetra Tech project manager will prepare a monthly status report (MSR) to be submitted to Tetra Tech's program manager and the Navy RPM. MSRs address project-specific quality issues and facilitate their timely communication. The MSR will include the following quality-related information:

- Project status
- Instrument, equipment, or procedural problems that affect quality and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

If appropriate, Tetra Tech will obtain similar information from subcontractors who are participating in the project and will incorporate the information within the MSR.

3.2.3 Quality Control Summary Report

Tetra Tech will prepare a QCSR that will be submitted to the Navy RPM with the final report for the field investigation. The QCSR will include a summary and evaluation of QA/QC activities, including any field or laboratory assessments, completed during the investigation. The QCSR will also indicate the location and duration of storage for the complete data packages. Particular emphasis will be placed on determining whether project DQOs were met and whether data are of adequate quality to support required decisions.

4.0 DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs and MQOs for the project.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Validation and verification of the data generated during field and laboratory activities are essential to obtaining defensible data of acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

4.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called "outliers." A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

4.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

4.1.3 Laboratory Data Validation

An independent, third-party contractor will validate all laboratory data (except IDW characterization) in accordance with current EPA national functional guidelines (EPA 1994, 1999b). The data validation strategy will be consistent with Navy guidelines. For this project, 80 percent of the data for analytes of concern will undergo cursory validation and 20 percent of the data for analytes of concern will undergo full validation. Requirements for cursory and full validation are listed below.

4.1.3.1 Cursory Data Validation

Cursory validation will be completed on 80 percent of the summary data packages for analysis of analytes of concern. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of the data from the review process is not allowed. All data will be qualified as necessary in accordance with established criteria. Data summary packages will consist of sample results and QC summaries, including calibration and internal standard data.

4.1.3.2 Full Data Validation

Full validation will be completed on 20 percent of the full data packages for analysis of analytes of concern. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. All data will continue through the validation process and will be qualified in accordance with established criteria. Data summary packages will consist of sample results, QC summaries, and all raw data associated with the sample results and QC summaries.

4.1.3.3 Data Validation Criteria

Table 11 lists the QC criteria that will be reviewed for both cursory and full data validation. The data validation criteria selected from Table 11 will be consistent with the project-specific analytical methods referenced in Section 2.4 of the SAP.

TABLE 11: DATA VALIDATION CRITERIA
Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analytical Parameter Group	Cursory Data Validation Criteria	Full Data Validation Criteria
Inorganic Analyses	Method compliance Holding times Calibration Blanks MS/MSD recovery LCS or blank spike Field duplicate sample analysis Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks MS/MSD recovery LCS Field duplicate sample analysis Other laboratory QC specified by the method Detection limits Analyte identification Analyte quantitation Sample results verification Overall assessment of data for an SDG

Notes:

LCS	Laboratory control sample	SAP	Sampling and analysis plan
MS/MSD	Matrix spike/matrix spike duplicate	SDG	Sample delivery group
QC	Quality control		

4.2 RECONCILIATION WITH USER REQUIREMENTS

After environmental data are reviewed, verified, and validated in accordance with the procedures described in Section 4.1, the data must be further evaluated to determine whether DQOs have been met.

To the extent possible, Tetra Tech will follow EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's "Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QA00 Update" (EPA 2000c). The DQA process includes the following five steps: (1) review the DQOs and sampling design, (2) conduct a preliminary data review, (3) select a statistical test, (4) verify the assumptions of the statistical test, and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative, Tetra Tech will systematically assess data quality and data usability. This assessment will include:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives.
- A review of project-specific data quality indicators for PARRC parameters and quantitation limits (defined in Section 1.3.2) to determine whether acceptance criteria have been met.
- A review of project-specific DQOs to determine whether they have been achieved by the data collected.
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared with a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

The final report for the project will discuss any potential affects of these reviews on data usability and will clearly define any limitations associated with the data.

REFERENCES

Agency for Toxic Substance and Disease Registry (ATSDR). 2004. "Public Health Statement for Arsenic." http://www.atsdr.cdc.gov/toxprofiles/phs2.html. Webpage accessed on September 10, 2004.

ATSDR. 2005. Health Consultation Evaluation of Soil Arsenic Concentrations in the Magazine Study Area. Naval Weapons Station Seal Beach Detatachment Concord, Concord, California. March 28.

American Public Health Association, American Water Works Association, and Water Environmental Federation (APHA). 1992. *Standard Methods for the Examination of Water and Wastewater, 18th Edition.* APHA Publication Office.

Contra Costa Health Department, Environmental Health Division. 1997. Letter Regarding Underground Storage Tank (UST) Removal, Concord Naval Weapons Site 7SH5. From Sue Loyd, Hazardous Materials Specialist. To Officer in Charge of Construction, Naval Facilities Engineering Command. April 8.

Contra Costa Gazette. 1947. Newspaper Article titled "Hay Feared Poisoned to be Burned." May 10.

Cowherd, C., G. Muleski, P. Engelhart, and D. Gillette. 1985. *Rapid Assessment of Exposure to Particulate Emission from Surface Contamination*. EPA/600/8-85/002. Prepared for Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Washington, DC. NTIS PB85-1922197AS.

Ecology and Environment Inc. 1983. "Initial Assessment Study of Naval Weapons Station, Concord, CA." June.

Harding Lawson Associates (HLA). 1995. "Final Submittal, Phases I and II Subsurface Investigation and Tank Removal Plan, Concord Naval Weapons Station, Concord, California. January 3.

Hassig, N.L., J.E. Wilson, R.O. Gilbert, D.K. Carlson, R.F. O'Brien, B.A. Pulsipher, C.A. McKinstry, and D.J. Bates. "Visual Sampling Plan Version 2.0 User's Guide." Pacific Northwest Laboratory, PNNL-14002. September.

K.T.W & Associates, Inc. 1998. "Closure Report of Underground Storage Tank Site 7SH5." February.

Naval Facilities Engineering Service Center (NFESC). 1999. *Navy Installation Restoration Chemical Data Quality Manual (IRCDQM).* Special Report SP-2056-ENV. September.

NFESC. 2000. "Appendix D: *In vitro* Method for Determination of Lead Bioavailability: Standard Operating Procedure for Stomach Phase Extraction." NFESC User's Guide, UG-2049-ENV. July.

NFESC. 2002. "Guidance for Environmental Background Analysis, Volume I: Soil." NFESC User's Guide, UG-2049-ENV. April.

PRC Environmental Management Inc. (PRC). 1993. "Draft Final Inland Area Sites, Site Investigation Report, Naval Weapons Station, Concord, California." March.

PRC. 1997. "Final Resource Conservation and Recovery Act (RCRA) facility assessment (RFA), Naval Weapons Station, Concord, California." August.

San Francisco Bay California Regional Water Quality Control Board (SFBRWQCB). 2005. "Screening For Environmental Concerns at Sites with Contaminated Soil and Groundwater (Interim Final - February 2005)." California Regional Quality Control Board – San Francisco Bay Region. February.

SFBRWQCB. 2005. Email Correspondence between the RWQCB and the Navy Regarding the Surface Water Ambient Monitoring Program. February 16.

Tetra Tech Inc. 2002. "Integrated Natural Resources Management Plan and Environmental Assessment, Naval Weapons Station Seal Beach, Detachment Concord, California." March 20.

Tetra Tech EM Inc (Tetra Tech). 1997. "Draft Final Remedial Investigation Report Inland Area Sites 13, 17, 22, 24A, Naval Weapons Station Concord, Concord, California." October.

Tetra Tech. 1998a. "Phase II RI, Inland Area Site 22, Building 7SH5, Naval Weapons Station Concord, Concord, California." April.

Tetra Tech. 1998b. "Draft ROD, Inland Area Sites 13, 17, 22 and 27, Weapons Support Facility Seal Beach Detachment Concord, Concord, California." August.

Tetra Tech. 1999. "Draft Site Investigation Report for Site 29, Naval Weapons Station Seal Beach Detachment." July 23.

Tetra Tech. 2002. "Tetra Tech EM Inc. Laboratory Analytical Statement of Work." January.

Tetra Tech. 2003. "Draft Supplemental Remedial Investigation Installation Restoration Site 22, Naval Weapons Seal Beach Detachment Concord, Concord, California." February 12.

Tetra Tech. 2004a. "Informal Dispute Resolution Summary and Proposed Sampling at the Magazine Area and Installation Restoration Sites 22, 27, and 29, at the Naval Weapons Station Seal Beach Detachment Concord, Concord California." March 14.

Tetra Tech. 2004b. "Draft Data Tables and Figures for the June/July 2004 Sampling Event." October 18.

University of Iowa College of Public Health. 2003. Website. http://www.public-health.uiowa.edu/fuortes/Text/pst_trt.htm. Accessed June 16, 2003.

U.S. Department of the Navy (Navy). 2004. “Informal Dispute Resolution Summary and Proposed Sampling at the Magazine Area and Installation Restoration Sites 22, 27, and 29 an Naval Weapons Station Seal Beach, Detachment Concord, Concord, California.” March 15.

U.S. Environmental Protection Agency (EPA). 1983. “Methods for Chemical Analysis of Water and Waste. March.

EPA. 1992. “Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers.” Office of Solid Waste and Emergency Response (OSWER) Directive No. 9240.0-05A. April.

EPA. 1994. “National Functional Guidelines for Inorganic Data Review.” EPA-540/R-94/013. Office of Emergency and Remedial Response. Washington, DC. February.

EPA. 1996. “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Update III.” OSWER. Washington, DC. December.

EPA. 1999a. “U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration.” Document Number OLM04.2. May.

EPA. 1999b. “National Functional Guidelines for Organic Data Review.” EPA-540/R-99-008. Office of Emergency and Remedial Response. Washington, DC. October.

EPA. 2000a. “U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration.” Document Number ILM04.1. January.

EPA. 2000b. “Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/G-4HW).” EPA/600/R-00/007. Office of Environmental Information. Washington, DC. January.

EPA. 2000c. “Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QA00 Update.” EPA/600/R-96-084. Office of Environmental Information. Washington, DC. July.

EPA. 2000d. “Guidance for the Data Quality Objectives Process, EPA QA/G-4.” EPA/600/R-96/055. Office of Environmental Information. Washington, DC. August.

EPA. 2001. “EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5.” EPA/240/B-01/003. Office of Environmental Information. Washington, DC. March.

EPA. 2004. “Region 9 Preliminary Remediation Goals.” October. Available On-line at http://www.epa.gov/region09/waste/sfund/prg/index.html

APPENDIX A
SITE 22 PHOTOGRAPHS

This appendix presents photographs taken during the supplemental sampling conducted in June 2003 and July 2004 at Installation Restoration Site 22, Naval Weapons Station Seal Beach Detachment Concord in Concord, California.

Photograph A-1: View of the western border area of Site 22, looking south to north. The double fence line that separates Navy property from the residential area in the southwestern portion of site is shown in the background. June 2004.

Photograph A-2: South end of Building 7SH5. June 2004.

Photograph A-3: Tule elk at NWSSBD Concord, representative of the herd that frequents Site 22. Undated photograph.

Photograph A-4: Representative view of the central magazine area at Site 22, looking north. June 2004.

Photograph A-5: Richard Vernimen (Tetra Tech EM Inc. [Tetra Tech]) recording water quality parameters during low-flow purging and sampling at monitoring well 7SHMW001. June 2004.

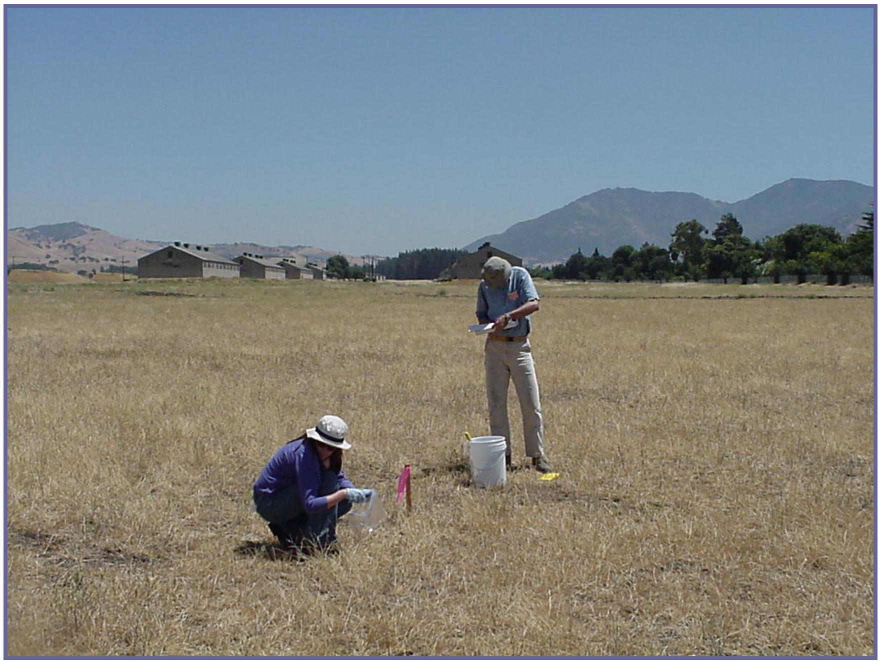
Photograph A-6: View of direct-push sampling rig used to collect subsurface soil samples in limited access areas. July 2004.

Photograph A-7: Richard Vernimen (Tetra Tech) logging soil from sampling location 7SHSB150. July 2004.

Photograph A-8: Patrick Callahan (Tetra Tech) collecting surface soil sample at Site 22 using a disposable scoop. Vegetation was cleared before the soil sample was collected. July 2004.

Photograph A-9: James Medley (Tetra Tech) collecting a soil sample at location 7SHSB155. The photograph view is looking north from location 7SHSB155, between the two fences described as the double fence line that separates Navy property from residential property at the southwestern boundary of the site. Soil in this area is tilled for fire control. July 2004.

Photograph A-10: James Medley (Tetra Tech) collecting a soil sample at location 7SHSB152, within the double fence line. A community swimming pool is pictured in the background, beyond the fence. July 2004.



Photograph A-11: Joanna Canepa (Tetra Tech) collecting a vegetation sample at location 7SHSB123. The photograph view is looking south from the sampling location. July 2004.

APPENDIX B
IN VITRO METHOD FOR DETERMINATION OF LEAD BIOACCESSIBLITY: STANDARD OPERATING PROCEDURE FOR STOMACH PHASE EXTRACTION

(Note: This method is presented as Appendix C to the "Guide for Incorporating Bioavailability Adjustments into Human Health and Ecological Risk Assessments at Department of Defense Facilities Part 2: Technical Background Document for Assessing Metals Bioavailability," and is available online at:
http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/bio_a/DoDbioa-guide-part2.pdf)

APPENDIX C

IN VITRO METHOD FOR DETERMINATION OF LEAD BIOACCESSIBILITY: STANDARD OPERATING PROCEDURE FOR STOMACH PHASE EXTRACTION

Appendix C

In Vitro Method for Determination of Lead Bioaccessibility:

Standard Operating Procedure for Stomach Phase Extraction

Prepared by:

Solubility/Bioavailability Research Consortium

For more information on the SOP please contact:

Michael Ruby
Exponent
Boulder, CO
(303) 444-7270
rubym@exponent.com

or

Dr. John Drexler
Dept. of Geological Sciences
Univ. of Colorado at Boulder
Boulder, CO
(303) 492-5251
drexlerj@spot.colorado.edu

Members of SBRC at the time of development of this SOP included:

Michael Ruby, Exponent, Boulder, CO
John Drexler, Ph.D., Dept. of Geological Sciences, Univ. of Colorado at Boulder, Boulder, CO
Willard Chappel, Ph.D., Dept. of Environmental Sciences, Univ. of Colorado at Denver, Denver, CO
Chris Weis, Ph.D., U.S. EPA Region VIII, Denver, CO
Stanley Christensen, U.S. EPA Region VIII, Denver, CO
Gloria Post, Ph.D., New Jersey Department of Environmental Protection, Trenton, NJ
Marion Harnois, Ph.D., Massachusetts Department of Environmental Protection, Boston, MA
Rosalind Schoof, Ph.D., Integral Consulting, Inc., Bellevue, WA
William Brattin, Ph.D., Syracuse Research Corporation, Denver, CO
Mary Goldade,Syracuse Research Corporation, Denver, CO
William Berti, Ph.D., DuPont, Newark, DE
Marguerite Carpenter, Ph.D., FMC Corporation, Princeton, PA
Deborah Edwards, Ph.D., ExxonMobil, Houston, TX
David Cragin, Ph.D., Cerexagri, Inc., King of Prussia, PA

Contents

1. Introduction

1.1 Synopsis

This SOP describes an *in vitro* laboratory procedure to determine a bioaccessibility value for lead or arsenic (i.e., the fraction that would be soluble in the gastrointestinal tract) for soils and solid waste materials. A recommended quality assurance program to be followed when performing this extraction procedure is also provided.

1.2 Purpose

An increasingly important property of materials/soils found at contaminated sites is the bioavailability of individual contaminants. Bioavailability is the fraction of a contaminant in a particular environmental matrix that is absorbed by an organism via a specific exposure route. Many animal studies have been conducted to experimentally determine the oral bioavailability of individual metals, particularly lead and arsenic. During the period 1989–1997, a juvenile swine model developed by EPA Region VIII was used to predict the relative bioavailability of lead and arsenic in approximately 20 soils/solid materials (Weis and LaVelle 1991; Weis et al. 1994; Casteel et al. 1997a,b). The bioavailability determined was relative to that of a soluble salt (i.e., lead acetate trihydrate or sodium arsenate). The tested materials had a wide range of mineralogy, and produced a range of lead and arsenic bioavailability values. In addition to the swine studies, other animal models (e.g., rats and monkeys) have been used to measure the bioavailability of lead and arsenic from soil.

Several researchers have developed *in vitro* tests to measure the fraction of a chemical solubilized from a soil sample under simulated gastrointestinal conditions. This measurement is referred to as "bioaccessibility" (Ruby et al. 1993). Bioaccessibility is thought to be an important determinant of bioavailability, and several groups have sought to compare bioaccessibility determined in the laboratory to bioavailability determined in animal studies (Imber 1993; Ruby et al. 1996; Medlin 1997; Rodriguez et al. 1999). The *in vitro* tests consist of an aqueous fluid, into which soils containing lead and arsenic are introduced. The solution then solubilizes the soil under simulated gastric conditions. Once this procedure is complete, the solution is analyzed for lead and/or arsenic concentration. The mass of lead and/or arsenic found in the aqueous phase, as defined by filtration at the 0.45-μm pore size, is compared to the mass introduced into the test. The fraction liberated into the aqueous phase is defined as the bioaccessible fraction of lead or arsenic in that soil. To date, for lead-bearing soils tested in the EPA swine studies, this *in vitro* method has correlated well with relative bioavailability values.

2. Procedure

2.1 Sample Preparation

All soil/material samples should be prepared for testing by oven drying (<40 °C) and sieving to <250 μm. The <250-μm size fraction is used because this particle size is representative of that which adheres to children's hands. Subsamples for testing in this procedure should be obtained using a sample splitter.

2.2 Apparatus and Materials

2.2.1 Equipment

The main piece of equipment required for this procedure consists of a Toxicity Characteristic Leaching Procedure (TCLP) extractor motor that has been modified to drive a flywheel. This flywheel in turn drives a Plexiglass block situated inside a temperature-controlled water bath. The Plexiglass block contains ten 5-cm holes with stainless steel screw clamps, each of which is designed to hold a 125-mL wide-mouth high-density polyethylene (HDPE) bottle (see Figure 1). The water bath must be filled such that the extraction bottles are immersed. Temperature in the water bath is maintained at 37±2 °C using an immersion circulator heater (for example, Fisher Scientific Model 730). Additional equipment for this method includes typical laboratory supplies and reagents, as described in the following sections.

The 125-mL HDPE bottles must have an air-tight screw-cap seal (for example, Fisher Scientific 125-mL wide-mouth HDPE Cat. No. 02-893-5C), and care must be taken to ensure that the bottles do not leak during the extraction procedure.

2.2.2 Standards and Reagents

The leaching procedure for this method uses a buffered extraction fluid at a pH of 1.5. The extraction fluid is prepared as described below.

The extraction fluid should be prepared using ASTM Type II deionized (DI) water. To 1.9 L of DI water, add 60.06 g glycine (free base, Sigma Ultra or equivalent). Place the mixture in a water bath at 37 °C until the extraction fluid reaches 37 °C. Standardize the pH meter using temperature compensation at 37 °C or buffers maintained at 37 °C in the water bath. Add concentrated hydrochloric acid (12.1 N, Trace Metal grade) until the solution pH reaches a value of 1.50 ±0.05 (approximately 120 mL). Bring the solution to a final volume of 2 L (0.4 M glycine).

Cleanliness of all reagents and equipment used to prepare and/or store the extraction fluid is essential. All glassware and equipment used to prepare standards and reagents must be properly cleaned, acid washed, and finally, rinsed with DI water prior to use. All reagents must be free of lead and arsenic, and the final fluid should be tested to confirm that lead and arsenic concentrations are less than 25 and 5 μg/L, respectively.

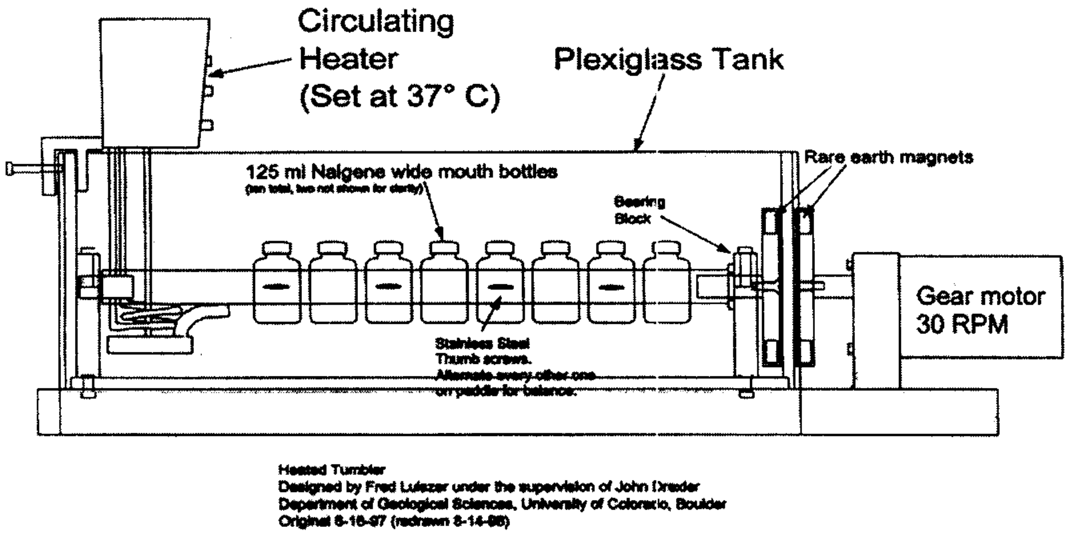


Figure 1. Extraction device for performing the SBRC *in vitro* extraction

2.3 Leaching Procedure

Measure 100 ±0.5 mL of the extraction fluid, using a graduated cylinder, and transfer to a 125-mL wide-mouth HDPE bottle. Add 1.00 ±0.05 g of test substrate (<250 μm) to the bottle, ensuring that static electricity does not cause soil particles to adhere to the lip or outside threads of the bottle. If necessary, use an antistatic brush to eliminate static electricity prior to adding the soil. Record the volume of solution and mass of soil added to the bottle on the extraction test checklist (see Attachment A for example checklists). Hand-tighten each bottle top, and shake/invert to ensure that no leakage occurs, and that no soil is caked on the bottom of the bottle.

Place the bottle into the modified TCLP extractor, making sure each bottle is secure and the lid(s) are tightly fastened. Fill the extractor with 125-mL bottles containing test materials or Quality Control samples.

The temperature of the water bath must be 37±2 °C. Record the temperature of the water bath at the beginning and end of each extraction batch on the appropriate extraction test checklist sheet (see Attachment A).

Rotate the extractor end over end at 30±2 rpm for 1 hour. Record start time of rotation.

When extraction (rotation) is complete, immediately remove bottles, wipe them dry, and place them upright on the bench top.

Draw extract directly from reaction vessel into a disposable 20-cc syringe with a Luer-Lok attachment. Attach a 0.45-μm cellulose acetate disk filter (25 mm diameter) to the syringe, and filter the extract into a clean 15-mL polypropylene centrifuge tube or other appropriate sample vial for analysis. Store filtered sample(s) in a refrigerator at 4 °C until they are analyzed.

Record the time that the extract is filtered (i.e., extraction is stopped). If the total elapsed time is greater than 1 hour 30 minutes, the test must be repeated.

Measure and record the pH of fluid remaining in the extraction bottle. If the fluid pH is not within ±0.5 pH units of the starting pH, the test must be discarded and the sample reanalyzed as follows.

If the pH has dropped by 0.5 or more pH units, the test will be re-run in an identical fashion. If the second test also results in a decrease in pH of greater than 0.5 s.u., the pH will be recorded, and the extract filtered for analysis. If the pH has increased by 0.5 or more units, the test must be repeated, but the extractor must be stopped at specific intervals and the pH manually adjusted down to pH 1.5 with dropwise addition of HCl (adjustments at 5, 10, 15, and 30 minutes into the extraction, and upon final removal from the water bath [60 minutes]). Samples with rising pH values must be run in a separate extraction, and must not be combined with samples being extracted by the standard method (continuous extraction).

Extracts are to be analyzed for lead and arsenic concentration using analytical procedures taken from the U.S. EPA publication, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. SW-846.* (current revisions). Inductively coupled plasma (ICP) analysis, method 6010B (December 1996 revision) will be the method of choice. This method should be adequate for determination of lead concentrations in sample extracts, at a project-required detection limit (PRDL) of 100 μg/L. The PRDL of 20 μg/L for arsenic may be too low for ICP analysis for some samples. For extracts that have arsenic concentrations less than five times the PRDL (e.g., <100 μg/L arsenic), analysis by ICP-hydride generation (method 7061A, July 1992 revision) or ICP-MS (method 6020, September 1994 revision) will be required.

2.4 Calculation of the Bioaccessibility Value

A split of each solid material (<250 μm) that has been subjected to this extraction procedure should be analyzed for total lead and/or arsenic concentration using analytical procedures taken from the U.S. EPA publication, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. SW-846.* (current revisions). The solid material should be acid digested according to method 3050A (July 1992 revision) or method 3051 (microwave-assisted digestion, September 1994 revision), and the digestate analyzed for lead and/or arsenic concentration by ICP analysis (method 6010B). For samples that have arsenic concentrations below ICP detection limits, analysis by ICP-hydride generation (method 7061A, July 1992 revision) or ICP-MS (method 6020, September 1994 revision) will be required.

The bioaccessibility of lead or arsenic is calculated in the following manner:

$$Bioaccessibility\ (\%) = \frac{(concentration\ in\ in\ vitro\ extract,\ mg/L)\ (0.1L - fluid)}{(concentration\ in\ solid,\ mg/kg)\ (0.001\ kg - soil)} \times 100$$

2.5 Chain-of-Custody/Good Laboratory Practices

All laboratories that use this SOP should receive test materials with chain-of-custody documentation. When materials are received, each laboratory will maintain and record custody of samples at all times. All laboratories that perform this procedure should follow good laboratory practices as defined in 40 CFR Part 792 to the extent practical and possible.

2.6 Data Handling and Verification

All sample and fluid preparation calculations and operations should be recorded in bound and numbered laboratory notebooks, and on extraction test checklist sheets. Each page must be dated and initialed by the person who performs any operations. Extraction and filtration times must be recorded, along with pH measurements, adjustments, and buffer preparation. Copies of the extraction test checklist sheets should accompany the data package.

3. Quality Control Procedures

3.1 Elements of Quality Assurance and Quality Control (QA/QC)

A standard method for the *in vitro* extraction of soils/solid materials, and the calculation of an associated bioaccessibility value, are specified above. Associated QC procedures to ensure production of high-quality data are as follows (see Table 1 for summary of QC procedures, frequency, and control limits):

- Reagent blank—Extraction fluid analyzed once per batch.
- Bottle blank—Extraction fluid only run through the complete extraction procedure at a frequency of no less than 1 per 20 samples or one per extraction batch, whichever is more frequent.
- Blank spikes—Extraction fluid spiked at 10 mg/L lead and/or 1 mg/L arsenic and run through the extraction procedure at a frequency of no less than every 20 samples or one per extraction batch, whichever is more frequent. Blank spikes should be prepared using traceable 1,000-mg/L lead and arsenic standards in 2 percent nitric acid.
- Duplicate—duplicate extractions are required at a frequency of 1 for every 10 samples. At least one duplicate must be performed on each day that extractions are conducted.
- Standard Reference Material (SRM)—National Institute of Standards and Technology (NIST) material 2711 (Montana Soil) should be used as a laboratory control sample (LCS).

Control limits for these QC samples are delineated in Table 1, and in the following discussion.

Table 1. Summary of QC Samples, Frequency of Analysis, and Control Limits

QC Sample	Minimum Frequency of Analysis	Control Limits
Reagent Blank	Once per batch (min. 5%)	<25 μg/L lead <5 μg/L arsenic
Bottle Blank	Once per batch (min. 5%)	<50 μg/L lead <10 μg/L arsenic
Blank Spike	Once per batch (min. 5%)	85–115% recovery
Duplicate	10%	±20% RPD
SRM (NIST 2711)	2%	9.22 ±1.50 mg/L Pb 0.59 ±0.09 mg/L As

3.2 QA/QC Procedures

Specific laboratory procedures and QC steps are described in the analytical methods cited in Section 2.3, and should be followed when using this SOP.

3.2.1 Laboratory Control Sample (LCS)

The NIST SRM 2711 should be used as a laboratory control sample for the *in vitro* extraction procedure. Analysis of 18 blind splits of NIST SRM 2711 (105 mg/kg arsenic and 1,162 mg/kg lead) in four independent laboratories resulted in arithmetic means ± standard deviations of 9.22 ±1.50 mg/L lead and 0.59 ±0.09 mg/L arsenic. This SRM is available from the National Institute of Standards and Technology, Standard Reference Materials Program, Room 204, Building 202, Gaithersburg, Maryland 20899 (301/975-6776).

3.2.2 Reagent Blanks/Bottle Blanks/Blank Spikes

Reagent blanks must not contain more than 5 μg/L arsenic or 25 μg/L lead. Bottle blanks must not contain arsenic and/or lead concentrations greater than 10 and 50 μg/L, respectively. If either the reagent blank or a bottle blank exceeds these values, contamination of reagents, water, or equipment should be suspected. In this case, the laboratory must investigate possible sources of contamination and mitigate the problem before continuing with sample analysis. Blank spikes should be within 15% of their true value. If recovery of any blank spike is outside this range, possible errors in preparation, contamination, or instrument problems should be suspected. In the case of a blank spike outside specified limits, the problems must be investigated and corrected before continuing sample analysis.

4. References

Casteel, S.W., R.P. Cowart, C.P. Weis, G.M. Henningsen, E. Hoffman, et al. 1997a. Bioavailability of lead in soil from the Smuggler Mountain site of Aspen, Colorado. Fund. Appl. Toxicol. 36:177–187.

Casteel, S.W., L.D. Brown, M.E. Dunsmore, C.P. Weis, G.M. Henningsen, E. Hoffman, W.J. Brattin, and T.L. Hammon. 1997b. Relative bioavailability of arsenic in mining waste. U.S. Environmental Protection Agency, Region VIII, Denver, CO.

Imber, B.D. 1993. Development of a physiologically relevant extraction procedure. Prepared for BC Ministry of Environment, Lands and Parks, Environmental Protection Division, Victoria, BC. CB Research International Corporation, Sidney, BC.

Medlin, E.A. 1997. An *in vitro* method for estimating the relative bioavailability of lead in humans. Master's thesis. Department of Geological Sciences, University of Colorado, Boulder.

Rodriguez, R.R., N.T. Basta, S.W. Casteel, and L.W. Pace. 1999. An in vitro gastrointestinal method to estimate bioavailable arsenic in contaminated soils and solid media. Environ. Sci. Technol. 33(4):642–649.

Ruby, M.W., A. Davis, T.E. Link, R. Schoof, R.L. Chaney, G.B. Freeman, and P. Bergstrom. 1993. Development of an *in vitro* screening test to evaluate the *in vivo* bioaccessibility of ingested mine-waste lead. Environ. Sci. Technol. 27(13):2870–2877.

Ruby, M.W., A. Davis, R. Schoof, S. Eberle, and C.M. Sellstone. 1996. Estimation of lead and arsenic bioavailability using a physiologically based extraction test. Environ. Sci. Technol. 30(2):422–430.

Weis, C.P., and J.M. LaVelle. 1991. Characteristics to consider when choosing an animal model for the study of lead bioavailability. In: Proceedings of the International Symposium on the Bioavailability and Dietary Uptake of Lead. Sci. Technol. Let. 3:113–119.

Weis, C.P., R.H. Poppenga, B.J. Thacker, and G.M. Henningsen. 1994. Design of phamacokinetic and bioavailability studies of lead in an immature swine model. In: Lead in paint, soil, and dust: Health risks, exposure studies, control measures, measurement methods, and quality assurance, ASTM STP 1226, M.E. Beard and S.A. Iske (Eds.). American Society for Testing and Materials, Philadelphia, PA, 19103-1187.

Attachment A:

Extraction Test Checklist Sheets

Extraction Fluid Preparation

Date of Extraction Fluid Preparation:____________ Prepared by:____________

Extraction Fluid Lot #:________________________

Component	Lot Number	Fluid Preparation 1L	Fluid Preparation 2L	Acceptance Range	Actual Quantity	Comments
Deionized Water		0.95 L (approx.)	1.9 L (approx.)	---		
Glycine		30.03±0.05 g	60.06±0.05g	---		
HCl [a]		60 mL (approx.)	120 mL (approx.)	---		
Final Volume	---	1 L (Class A, vol.)	2 L (Class A, vol.)	---		
Extraction Fluid pH value (@ 37°C)	---	1.50±0.05	1.50±0.05	1.45–1.55		

[a] Concentrated hydrochloric acid (12.1 N)

Required Parameters:

Volume of extraction fluid (V) = 100 ±0.5 mL
Mass of test substrate (M) = 1.00 ±0.05 g
Temperature of water bath = 37 ±2 °C
Extraction time = 60 ±5 min

Extractor rotation speed = 30 ±2 rpm
Maximum elapsed time from extraction to filtration = 90 minutes
Maximum pH difference from start to finish (ΔpH)= 0.5 pH units
Spike solution concentrations: As = 1 mg/L; Pb = 10 mg/L

Date of Extraction:________________________
Extraction Fluid Lot #:______________________
Extracted by:______________________________

As Spike Solution Lot #:______________________________
Pb Spike Solution Lot #:______________________________

Extraction Log:

Sample ID	Sample Preparation		Extraction								Filtration	
	V (mL)	M (g)	Start Time[a]	End Time[a]	Elapsed Time (min)	Start pH	End pH	ΔpH	Start Temp (°C)	End Temp (°C)	Time[a]	Time Elasped from extraction (min)
Acceptance Range	(95.5–100.5)	(0.95–1.05)	---	---	(55–65 min)	---	---	(Max = 0.5)	(35–39)	(35–39)		(Max = 90 min)
Bottle Blank												
Duplicate												
Matrix spike												

[a] 24-hour time scale

Analytical Procedures

QC Requirements:

QC Sample	Minimum Analysis Frequency	Control Limits	Corrective Action[a]
Reagent blank	once per batch (min. 5%)	< 25 µg/L Pb <5 µg/L As	Investigate possible sources of target analytes. Mitigate contamination problem before continuing analysis.
Bottle blank	once per batch (min. 5%)	< 50 µg/L Pb <10 µg/L As	Investigate possible sources of target analytes. Mitigate contamination problem before continuing analysis.
Blank spike	once per batch (min. 5%)	85–115%	Re-extract and reanalyze sample batch
Duplicate	10% (min. once/day)	±20% RPD	Re-homongenize, re-extract and reanalyze

RPD – Relative percent difference
a – Action required if control limits are not met

APPENDIX C
METHOD PRECISION AND ACCURACY GOALS

TABLE C-1: PRECISION AND ACCURACY GOALS

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Compound	QC Type	Analytical Method	Precision (RPD) [a]	Accuracy (% Rec) [b]
			Soil	**Soil**
Metals				
Arsenic (ICP-MS)	MS	EPA 6020	NA	75-125
	LCS	EPA 6020	NA	80-120
	Duplicate	EPA 6020	35	NA
Arsenic Bioavailability	LCS	NFESC – *In Vitro* Method	NA	85-115
	Duplicate	NFESC – *In Vitro* Method	20	NA

Notes:

a Precision as relative percent difference (RPD)
b Accuracy as percent recovery (% R)

%R Percent recovery
EPA Environmental Protection Agency
ICP-MS Inductively coupled plasma – mass spectrometry
LCS Laboratory control sample (blank spike)
MS Matrix spike
NFESC Naval Facilities Engineering Services Center
QC Quality control
RPD Relative percent difference

APPENDIX D
FIELD FORMS

Tetra Tech EM Inc.

Daily Quality Control Report

Project Name:	**Date:**
Project Number:	**Day:**
Weather:	**Wind:**
Temperature:	**Humidity:**

Personnel on Site

Field Team Leader:

Subcontractors on Site:

Equipment on Site

Work Performed (Including Sampling)

Quality Control Activities

Health and Safety Levels and Activities

Problems Encountered / Corrective Action Taken

Tetra Tech EM Inc.

Daily Quality Control Report

Deviations from Field Work Plan

Additional Notes

Anticipated Activities for Tomorrow

Distribution:	**Submitted By:**	
	Signature	**Date**

Audit Report

Tetra Tech EM Inc.

Project Name: ____________________ Date of Audit: ____________________

Project No.: ____________________ Project Manager: ____________________

Audit Team Members: ____________________

Brief Description of Project:

Audit Summary:

Corrective Action Required:

Quality Improvement Opportunities:

Remarks:

Auditor Signature: ____________________ Date: ____________________

cc: TtEMI Program QA Manager

Corrective Action Request Form
(Page 1 of 2)

Tetra Tech EM Inc.

Project Name: ______________________ **Date:** ______________________

Project No.: ______________________ **Project Manager:** ______________________

Location: ______________________

To (Project Manager): ______________________

From (Audit Team Members): ______________________

Description of Problem:

____

____

____

____

Corrective Action Required:

____

____

____

____

The above corrective action must be completed by (Date): ______________________

Acknowledgement of Receipt

____

(Signature and Date)

Corrective Action Request Form

Tetra Tech EM Inc.

Corrective Action Taken:

____

____

____

____

Project Manager: ______________________________

(Signature and Date)

Audit Team Members:

Corrective Action *is / is not* satisfactory

____

(Date and Initial)

Remarks: ______________________________

____

____

____

____

QC Coordinators:

Corrective Action *is / is not* satisfactory

____

(Date and Initial)

Remarks: ______________________________

____

____

____

____

cc: Program QA Manager

Daily Tailgate Safety Meeting Form

Date: ____________________ Time: ____________________ Job Number: ____________________

Client: ____________________ Site Location: ____________________

Scope of Work: ____________________

Safety Topics Presented

Planned Field Activities for the Day: ____________________

Protective Clothing / Equipment: ____________________

Chemical Hazards: ____________________

Physical Hazards: ____________________

Special Equipment: ____________________

Decontamination Procedures: ____________________

Other: ____________________

Emergency Procedures: ____________________

Hospital: ____________ Phone: ____________ Ambulance Phone: ____________________

Hospital Address and Route: ____________________

Employee Questions / Comments: ____________________

Attendees

Name (Printed)	Signature

Meeting Conducted By:

Name (Printed) / Signature	Name (Printed) / Signature
Site Safety Coordinator	Project Field Manager

Tetra Tech EM Inc.
San Francisco Office

135 Main St. Suite 1800
San Francisco. CA 94105
415-543-4880
Fax 415-543-5480

Chain of Custody Record No. ______

Page ____ of ____

Lab PO#:	Lab:

Project name:	TtEMI technical contact:	Field samplers:
Project (CTO) number:	**TtEMI project manager:**	**Field samplers' signatures:**

Sample ID	Sample Location (Pt. ID)	Date	Time	Matrix	MS / MSD	No./Container Types: 40 ml VOA	1 liter Amber	500 ml Poly	Sleeve	Glass Jar				Analysis Required (Preservative Added): VOA	SVOA	Pest/PCBs	Metals	TPH Purgeables	TPH Extractables										

	Name (print)	Company Name	Date	Time
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

Turnaround time/remarks:

Fed Ex #:

WHITE-Laboratory Copy YELLOW-Sample Tracker PINK-File Copy

APPENDIX E
PROJECT-REQUIRED REPORTING LIMITS

TABLE E-1: COMPARISON OF PROJECT-REQUIRED REPORTING LIMITS AND SCREENING CRITERIA FOR METALS ANALYSIS

Final SAP, Additional Investigation at Site 22 - Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Compound	Residential Soil PRG (mg/kg)	Industrial Soil PRG (mg/kg)	Ambient Metal Concentrations at Site 22 Inland Area (mg/kg) [a]	Soil PRRL (mg/kg)	Soil PRRL[b] Below Criteria?
Arsenic	0.39	1.6	10	0.25	Yes

Notes:

a Tetra Tech EM Inc (Tetra Tech). 1997. "Draft Final Remedial Investigation Report Inland Area Sites 13, 17, 22, 24A, Naval Weapons Station Concord, Concord, California." October.

b The PRRL listed reflects the maximum sensitivity of current, routinely used analytical methods. The PRRL listed will be used as the project screening criteria unless reasonable grounds are established for pursuing nonroutine methods.

µg/kg Micrograms per kilogram
NA Not available
PRG Preliminary remediation goal (U.S. Environmental Protection Agency [EPA] 2004)
PRRL Project-required reporting limit
SAP Sampling and analysis plan

APPENDIX F
APPROVED NAVY LABORATORIES

TABLE F-1: TETRA TECH EM INC.–APPROVED NAVY LABORATORIES UNDER BASIC ORDERING AGREEMENT

Final SAP, Additional Investigation at Site 22 – Southwest Fence Line and Seal Creek,
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analytical Group	
Lab Address:	12189 Pennsylvania Street Thornton, CO 80241
Point of Contact:	Joe Egry / Mary Fealey
Phone:	(800) 873-8707 X103/X135
Fax:	(303) 469-5254
Business Size:	SWO
E-mail:	mfealey@analyticagroup.com

Applied Physics and Chemistry Laboratory	
Lab Address:	13760 Magnolia Avenue Chino, CA 91710
Point of Contact:	Dan Dischner / Eric Wendland
Phone:	(909) 590-1828 X203/X104
Fax:	(909) 590-1498
Business Size:	SDB
E-mail:	marketing@apclab.com

Columbia Analytical Services	
Lab Address:	5090 Caterpillar Road Redding, CA 96003
Point of Contact:	Karen Sellers / Howard Boorse
Phone:	(530) 244-5262 / (360) 577-7222
Fax:	(530) 244-4109
Business Size:	LB
E-mail:	

Curtis and Tompkins, Ltd	
Lab Address:	2323 Fifth Street Berkeley, CA 94710
Point of Contact:	Anna Pajarillo / Mike Pearl
Phone:	(510) 486-0925 X103/ X108
Fax:	(510) 486-0532
Business Size:	SB
E-mail:	

EMAX Laboratories Inc.	
Lab Address:	1835 205th Street Torrance, CA 90501
Point of Contact:	Ye Myint / Jim Carter
Phone:	(310) 618-8889 X121/X105
Fax:	(310) 618-0818
Business Size:	SDB/WO
E-mail:	ymyint@emaxlabs.com

Laucks Laboratories	
Lab Address:	940 S. Harney Street Seattle, WA 98108
Point of Contact:	Mike Owens / Kathy Kreps
Phone:	(206) 767-5060
Fax:	(206) 767-5063
Business Size:	SB
E-mail:	KathyK@laucksslabs.com

Sequoia Analytical	
Lab Address:	1455 McDowell Blvd. North, Suite D Petaluma, CA 94954
Point of Contact:	Michelle Wiita
Phone:	(707) 792-7517
Fax:	(707) 792-0342
Business Size:	LB
E-mail:	

Notes:

LB	Large business
SAP	Sampling and analysis plan
SB	Small business
SDB	Small disabled business
SWO	Small woman-owned
WO	Woman-owned

APPENDIX G
RESPONSE TO REGULATORY AGENCY AND PUBLIC COMMENTS ON DRAFT AND DRAFT FINAL SAP

RESPONSE TO REGULATORY AGENCY AND PUBLIC COMMENTS ON THE DRAFT AND DRAFT FINAL SAMPLING AND ANALYSIS PLAN ADDITIONAL INVESTIGATION AT SITE 22 SOUTHWEST FENCE LINE AND SEAL CREEK, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD CONTRA COSTA COUNTY, CALIFORNIA

This appendix presents the U.S. Department of the Navy responses to comments from U.S. Environmental Protection Agency (EPA), the California Department of Toxic Substances Control (DTSC), the California Department of Fish and Game (DFG), the California Regional Water Quality Control Board (Water Board), and Mr. Gregory Glaser (RAB Member) on the Draft Sampling and Analysis Plan (SAP) for Additional Investigation at Site 22, Southwest Fence Line and Seal Creek, Naval Weapons Station Seal Beach Detachment Concord, dated May 12, 2005. The comments addressed below were received from EPA on July 14, 2005, DTSC on July 22, 2005, DFG on July 14, 2005, the Water Board on July 18, 2005, and Mr. Glaser on August 16, 2005.

Also included as part of this response are written comments received from DFG on the draft final SAP on September 22, 2005. The responses to comments on the draft SAP shown *in italics* have been modified to reflect EPA's request to add additional sediment samples in Mount Diablo Seal Creek and Site 22 and in the Inland Area Magazines A through D. Comment responses that were deleted due to changes made to finalize this SAP are shown in red-line/strikeout mode.

RESPONSES TO EPA COMMENTS

GENERAL COMMENTS

1. **Comment:** **The Navy proposes to collect a total of 20 surface samples (0-0.5-foot below ground surface or bgs) for arsenic from four additional munitions storage areas (identified as Magazine Areas A-D) that total 458 acres. While U.S. EPA understands that one of the objectives of the investigation is to confirm the general conceptual site model established for Site 22, U.S. EPA believes additional sampling data should be collected to better characterize the lateral and vertical extent of soil contamination associated with the Magazine Area and its associated subareas. At a minimum, U.S. EPA requests that the Navy double the number of soil samples that are proposed for each respective magazine storage area. Also, U.S. EPA requests that the Navy utilize more detailed sampling objectives to better assess the potential difference in contaminant concentrations from subareas of the magazine storage areas, for example, soils placed on top of individual bunkers, soils adjacent to railroad ballasts, sediment in drainage ditches, and soils in open spaces.**

Response: The purpose of the sampling in Inland Area Magazines "A through D" is to confirm whether herbicides that contained arsenic may have been applied in a similar fashion to the Site 22 Magazine Area. The proposed sampling and analysis for these four areas is meant to provide a Site Inspection (SI) level of data that can confirm or deny the need for an RI. As discussed in Step 7 of the data quality objectives (DQO) table, the number of sampling locations proposed in the SAP in these areas is based on the areal extent of each of the Inland Area Magazine. Like Site 22, the sample locations proposed for Inland Area Magazines A through D were selected randomly. Because the locations were random, some locations are adjacent to railroad tracks, ditches, or open space, and on top of individual bunkers. If herbicides that contained arsenic were applied at these sites, then concentrations of arsenic would be expected to be elevated above background levels throughout these areas. Thus, the Navy believes there is no reason to revise the DQOs stated. ~~However, the Navy has agreed to add 10 additional samples within inland area Magazines A through D as shown on Figure 3.~~

2. **Comment:** **The Navy proposes to collect a total of twelve sediment samples (at 0-0.5-feet bgs) from Mount Diablo Creek (three replicate sediment samples collected from four locations along the creek). While the addition of the three (3) replicate samples at each sampling location represents an expansion of the scope of work initially discussed by the Navy and the regulatory team several months ago, U.S. EPA requests that the Navy increase the number of sample collection sites within Mount Diablo Creek by two additional sampling locations. This would provide four sampling locations within the creek potentially impacted by Site 22, with one up-stream and one down-stream sampling locations. Also, U.S. EPA requests that the Navy include some deeper sediment samples to be utilized for the creek assessment.**

Response: ~~The Navy believes that a sufficient number of samples at appropriate locations are planned in the creek to meet the stated DQOs. Currently, one sample location is proposed upstream (sample location 7SHD001) and three are proposed downstream (sample locations 7SHD002 through 7SHD004). The downstream locations were selected due to their obviousness as older depositional areas. From previous field sampling events, elevated concentrations of arsenic were not detected in samples collected between the Site 22 Magazine Area and Seal Creek (although the Navy did not target drainage ditches; instead, samples were selected based on a random number generator). An additional phase of sampling may be warranted if concentrations of arsenic are significantly elevated compared with background. Likewise, subsurface sediment samples may be warranted in a future sampling event if sediment sampling indicates elevated concentrations of arsenic at the surface.~~

The Navy has discussed additional sampling with EPA in greater detail after publication of the draft final SAP. As a result of these discussions and the September 2005 site visit, the Final SAP includes an increase in the number of sediment samples locations at Site 22 and Mount Diablo/Seal Creek. Three discrete samples have been added to the downstream point of the creek, six samples have been added for low lying areas related to Drainage Areas A and B (Figure 6A), and three samples have been added in the abandoned Clayton Canal. In addition, ten samples were added to the assessment of the other four Inland Area Magazines, referred to in the SAP as Areas A through D.

3. **Comment:** **The Navy also proposes to collect 20 soil samples from residential off-site neighbors and Concord High School (two samples each at ten locations) to assess the lateral extent of surface contamination along the southwest Inland Area boundary. In general, U.S. EPA supports the Navy on this aspect of the Site 22 Sampling Plan and encourages the Navy to contact the property owners and secure sampling access for these properties as soon as possible.**

Response: The Navy plans to contact the property owners as soon as the SAP is approved.

SPECIFIC COMMENTS

1. **Comment:** **<u>Section 1, Project Description and Management, page 3 (Purpose of Investigation)</u>: For the Main Magazine Area, the Navy makes statements that suggest that arsenic detected in shallow soils may be a result of past farming practices. The first bullet on page 3 indicates the sampling objective is to "evaluate whether [contamination] at the Site 22 magazines either by the Navy or previous agricultural landowners has affected the off-site areas...". U.S. EPA's position on Site 22 is that arsenic contamination detected widespread in the Main Magazine Area surface soils appears to be attributed to Navy pest and plant control activities. Given that significant earth moving occurred during the building of the individual storage magazines, along with development of streets and drainage ditches, surface and shallow soil contamination detected in the Navy - altered soil layer can only be attributed to Navy pest control practices and not historical operations.**

Response: Comment noted. The Navy agrees with EPA that the primary source of elevated concentrations of arsenic in surface soils in the Site 22 Magazine Area is likely the historical application of arsenic-containing herbicides related to Navy pest and plant control. The sampling objective has been revised as follows:

"Evaluate whether the suspected historical application of an arsenic-containing herbicide at the Site 22 magazines has affected the off-site area southwest of the base's perimeter fence line and, if so, whether concentrations pose a risk to human health."

2. **Comment:** **<u>Section 1, page 7</u>. U.S. EPA requests that a clearer statement regarding the development and transmittal of a Remedial Investigation Report be made in the sampling plan. As an alternative to the statement on page 7 that, "[t]he results of the additional sampling will be summarized in a data package that will be submitted to the regulatory agencies", U.S. EPA requests that the Navy indicate that pursuant the Concord's June 10, 2005 Draft Site Management Plan, the Navy will be submitting a Draft Remedial Investigation Report scheduled for February 2, 2006. The Navy elected to develop a Draft RI Report because they will be integrating significant existing (2004 and earlier) sampling results with new (2005) sampling results.**

Response: The Navy has revised the text in Section 1.0 as suggested. The analytical data for soil from Inland Area Magazines A through D; however, will not be presented in the draft remedial investigation report. Instead, that data will be presented as a package that will include summary figures and tables.

3. **Comment:** **<u>Section 1.1.2, Problem to be Solved</u>: While the third bullet on page 9 correctly indicates that arsenic was not detected at elevated levels in soil samples collected between the magazine areas and Mount Diablo Creek, soil samples collected to date have not specifically targeted drainage ditches or other subareas of the site, other than open space. While U.S. EPA appreciates the Navy's willingness to assess Mount Diablo Creek in response to requests by U.S. EPA, we would also like to the Navy to recognize the potential the drainage ditches represent as a contaminant pathway to the creek.**

Response: Comment noted. Section 1.1.4, which discusses site drainage, was revised to indicate that surface drainage to Mount Diablo and Seal Creek from Site 22 is through a network of drainage ditches on the site.

4. **Comment:** **<u>Section 1.1.4, Physical Setting, Site Description, and Site History</u>: Regarding historical housekeeping practices for the magazine areas and individual munitions bunkers, text indicates on page 13 that, "...magazines were never flushed or steam cleaned. Instead, any residue observed in the magazines was contained in accordance with current standard operating procedures." Please clarify what is meant by 'residues were contained in accordance with current SOPs' (does this mean loose powders/explosive materials were contained, collected, and disposed of at one of the facilities burn or waste disposal areas?).**

Response: The munitions stored in the magazines were "ready to ship" explosives that were inspected and free from damage. There is no reason to suspect that explosive residues were present in the magazines because the condition of the munitions that were stored in the magazines was good. According to Richard Pieper, site director for Detachment Concord, there were no known spills at the magazines (Navy 2004). If explosive residues were encountered, they would have been handled as explosive hazardous waste. Records are not available to determine where any such residue, if encountered, was disposed of.

5. **Comment:** **<u>Section 1.2.1, Project Objectives (Magazine Area A-D Assessment); and Figure 3, Proposed Surface Soil Sampling Locations in the Magazine Areas</u>: As indicated above in General Comment number 1, U.S. EPA believes additional sampling data should be collected from Magazine Areas A-D to better characterize the lateral and vertical extend of soil contamination associated with the Magazine Areas. At a minimum, U.S. EPA requests that the Navy double the number of samples proposed for each Magazine Area and U.S. EPA requests that the Navy utilize more detailed sampling objectives to better assess contaminant concentrations is subareas of the sites; for example, soils placed on top of individual bunkers, soils adjacent to railroad ballasts, sediment in drainage ditches, and soils in open spaces. U.S. EPA has noted that previous sampling activities around Building 7SH5 detected elevated concentrations of arsenic adjacent to railroad ballasts; however, the Navy has not proposed additional sampling in Site 22 study area to confirm the extent of contamination along other Navy railroad right-of-ways. Also, the Navy should assess surface water flow paths in Magazine Areas A-D, and integrate any surface water flow features into the investigation.**

Response: Magazines A through D in the Inland Area have not previously been evaluated for the presence of arsenic in soils. This initial phase of sampling is intended to assess whether arsenic-containing herbicides were applied in these areas in a fashion similar to the Site 22 Magazine Area. The proposed sampling and analysis for these four areas is meant to provide a Site Inspection (SI) level of data that can confirm or deny the need for an RI. Figure 6B has been added to the SAP to depict surface drainage pathways in Magazine Areas A through D based on topography.

The Navy has added 10 additional soil samples to be collected in Inland Area Magazines A through D.

6. **Comment:** **<u>Section 1.2.1, Project Objectives (Mount Diablo Creek Assessment); and Figure 7, Proposed Sediment Sampling Locations in Mount Diablo/Seal Creek</u>: As indicated above in General Comment number 2, U.S. EPA requests that the Navy include two additional sampling locations (for replicate sampling) along the creek within the facility boundary. The down-stream sampling location (7SH5D004) while close to the area walked by the Navy and regulators several months ago, may not be located in the area of the creek where sedimentation is occurring. This furthest down-stream sampling location was to assess contaminant concentrations in sediment transported from the upper reaches and the Navy will need to document, that the location it selected is the terminal end of the creek (likely where creek surface flows intersect tidally influenced marsh surface water). This sampling site should be cited primarily based on the physical site conditions and not site access. U.S. EPA also encourages the Navy to contact the property owner(s) and secure sampling access for the down-stream sampling location as soon as possible.**

Response: *The sampling points near the terminus of Mount Diablo/Seal Creek were revised during the site visit on September 23, 2005, as shown on Figure 7.*

7. **Comment:** **<u>Section 1.2.1 and Figure 7 (Mount Diablo Creek Assessment)</u>: U.S. EPA support California Fish and Games July 1, 2005, general comment number 3 and reference to a previous February 23, 2005, memorandum on Solid Waste Management Units (SWMUs) Feasibility Study that recommended further characterization of Mount Diablo Creek to address potential contamination from the SWMUs sites. U.S. EPA supports Fish and Game' recommendations to analyze sediment samples from the creek near the SWMUs sites (sampling location 7SH5D003 and 7SH5D004) for metals, pesticides and total petroleum hydrocarbons (TPH).**

Response: Samples collected for this investigation will be submitted for analysis of arsenic only. On June 14, 2005 the Navy submitted its draft final remedial investigation (RI) report for the SWMU sites. Although EPA provided comments on that document in a letter dated August 26, 2004, the EPA did not dispute the report, and the comments related only to groundwater assessment, which could be addressed through the course of the FS. Per the Federal Facility Agreement (FFA), as of July 14, 2005 the draft final RI report served as the final RI report for the SWMU sites. On November 1, 2004, the Navy sent a letter to EPA with the Navy's responses to comments on the draft final RI report.

8. Comment: **<u>Section 1.2.1, and Figure 7 (Mount Diablo Creek Assessment)</u>: U.S. EPA understands that the Regional Water Quality Control Board may still have outstanding sampling requirements associated with a steam cleaning discharge pipe at Site 17, where the U.S. EPA is currently reviewing the Navy's Final No-Action Record of Decision (ROD). While Program staff have been supportive of the Navy's no-action decision and ROD, we believe the Navy could utilize the Site 22 Sampling Plan to document the collection of additional sediment data at the steam cleaning discharge pipe to cost effectively address a Site 17 characterization issue identified by the Regional Board. The Site 17 steam cleaning discharge pipe at Mount Diablo Creek represents a suitable location for one of the two additional sampling locations requested by U.S. EPA above in Specific Comment number 6.**

Response: The Navy believes that Site 17 has been adequately characterized under CERCLA and has signed a no further action ROD for the site in June 2005. Further assessment of petroleum issues at or near Site 17 will be addressed separately with the RWQCB.

9. Comment: **<u>Section 1.2.1, and Section 2.4, Analytical Methods</u>: U.S. EPA noted limited discussion in Sections 1.2.1 and 2.4, on the bioavailability assessment. California Fish and Game's July 1, 2005 (comment number 15) details their concerns (which are shared by U.S. EPA) indicating, "[a]dditional details on the leaching procedures are needed, either in the text or by including the protocol as an appendix. For example, at what pH and for how long will the leaching occur? For what type of organism (e.g., plant, invertebrate, or animal) does the leaching test estimate bioavailability? How does it compare to the neutral and acidic pH forms of the waste extraction test?"**

Response: The complete test method, "*In Vitro* Method for Determination of Lead Bioaccessiblity: Standard Operating Procedure for Stomach Phase Extraction," has been added as a separate appendix (Appendix B). The method was originally developed to evaluate lead but, as described in the details of the method, can also be applied for arsenic.

This method is also presented as Appendix C to the "Guide for Incorporating Bioavailabilty Adjustment for Human Health and Ecological Risk Assessment at Department of Defense Facilities Part II; Technical Background Document for Assessing Metals Bioavailability," which is available on line at (http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/bio_a/DoDbioa-guide-part2.pdf). Bioaccessibility is the fraction of a substance that is available for absorption by an organism. Bioavailability is the fraction of a substance that can be absorbed by the body through the gastrointestinal system, the pulmonary system, and the skin.

Soil is introduced into an aqueous solution with a pH of 1.5 in this *in vitro* method. Once the material is mixed, the solution is analyzed for arsenic. The mass of arsenic found in the aqueous phase, as defined by filtration at the 0.45-micron (µm) pore size, is compared with the mass introduced into the test. The fraction liberated into the aqueous phase is defined as the bioaccessible fraction of arsenic in soil.

This method has correlated well with relative bioavailability values from EPA studies of swine (see the test method). Juvenile swine were selected for use in the study because the gastrointestinal physiology and overall size of young swine are similar to those of young children, who are the population of prime concern for exposure to metals in soil. The pH used to leach the arsenic is significantly less than is used in waste extraction tests (pH of 5).

10. Comment: **Figure 6, Surface Drainage Map: The southern end of the Main Magazine Area is identified as Surface Drainage Area "G"and indicates, "Drains to Clayton Canal". Acknowledging that California Fish and Game has raised issues with regards to surface flows at Magazine Areas A-D in their July 1, 2005, Site 22 Sampling and Analysis Plan review, U.S. EPA requests that the Navy assess sediment in Clayton Canal at Drainage Area G. This section of canal was sampled by the Regional Board earlier this year and had arsenic detected in sampled standing water. While U.S. EPA does not believe that the abandoned Clayton Canal north of Mount Diablo Creek has the capability to transmit sediment south beneath the creek (because the siphon structure cannot function without full flows in the canal), sediment collected in the canal south of the creek may be transported south where the canal travels into the Dana Estates neighborhood (U.S. EPA's assumption on the Clayton Canal is that the structure was designed to transfer surface water from the Contra Costa Canal southeast into Clayton for irrigation purposes). The Navy should confirm the direction Clayton Canal flowed and the existence of any control structure that could restrict sediment transport as part of its investigation.**

Response: As shown on Figure 6A of the SAP, only a small portion of the southeastern corner of the magazine area (approximately 25 acres of 531 acres) drains surface water runoff into the Clayton Canal. As shown on Figure 4 of the SAP, concentrations of arsenic in the two soil samples collected to date from that portion of the site (7SHSB140 and 7SHSB142) were below the background concentration established for the site, of 10 milligrams per kilogram (mg/kg). No barriers other than natural vegetation exist to prevent soil or surface water from draining into the canal. The Clayton Canal, which branches from the Costa Contra Canal and is approximately 4.85 miles in length, has been abandoned since 1985. According to Jeff Quimby of the Contra Costa

Water District (CCWD), the canal was used to deliver water from CCWD's main canal to irrigation customers in eastern concord. Mr. Quimby indicated that water in the Clayton Canal at the base flowed to the southeast. The canal currently contains soil and grasses, as shown in the site photographs in Appendix A. Thus, the Clayton Canal is not habitat for fish, as indicated by the condition of the canal in the site photographs.

No portion of the Site 22 Magazine Area or Magazine Areas B, C, and D drains toward the Contra Costa Canal, which is an active canal managed by the Contra Costa Water District. A portion of the Contra Costa Canal is located southwest of Magazine Area A, as shown on Figure 3. At this time, it is unknown whether arsenic is present in surface soil at Magazine Area A. The purpose of the soil sampling proposed in the SAP is to evaluate whether there may have been a release of arsenic at the site.

As identified during the September 23, 2005, site visit, the Navy will collect three sediment/soil samples from within the abandoned Clayton Canal (Figure 7).

11. Comment: **Figure 9, Detected Groundwater Analytical Results for Monitoring Wells at Building 7SH5: For a more complete presentation of all groundwater data, please include the results of the 2004 groundwater grab sample collected at Building 7SH5 septic system (at location 7SH5B115A shown on Figure 9).**

Response: Results for grab groundwater samples were not posted for location 7SHB115A as no volatile organic compounds (VOCs) were detected at the location, and this figure shows only detected results. However, a note has been added to the legend indicating to the reader that samples were analyzed for VOCs, but were not detected at this location.

12. Comment: **<u>Table 4, Data Quality Objectives</u>: U.S. EPA reading of decision rule 2b in Step 5 is if concentrations of arsenic in down gradient creek samples are elevated when compared with ambient levels and samples from the upstream location are below the ambient, this data would suggest Navy-source(s), not a non-Navy source(s).**

Response: The text will be corrected to indicate Navy sources.

RESPONSES TO DTSC COMMENTS

GENERAL COMMENTS

1. **Comment:** **One of the Navy's stated objectives is to determine if arsenic is a contaminant of concern for Magazine Areas A, B, C and D. In reviewing the SAP it states that no previous remedial investigations have been performed in Magazine Areas A through D. This leaves the question if other contaminants are present in these Magazine Areas. DTSC recommends that a limited number of sampling points for other constituents be included to verify the Navy's assertion that arsenic in the prevailing contaminant of concern.**

   Response: Ecology and Environment conducted an initial assessment study at Concord Naval Weapons Station in 1983. Inland Area Magazines A through D were not identified as potential areas of concern because there was no indication of contaminant releases at the site. As a result, these magazines were not carried through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Inland Area Magazines A through D are currently proposed for investigation at the Site Inspection (SI) level because there is concern that arsenic-containing herbicides may have also been used in these areas. These site use history of these magazines is similar to the Site 22 Magazine Area, where arsenic is elevated in surface soil. Other pesticides, herbicides, metals, and explosives were not detected at elevated concentrations in the soil samples at Site 22. For these reasons, the investigation of the other Inland Area magazines focuses on arsenic only.

2. **Comment:** **The SAP proposes 20 sampling locations for the 458 Acres within the four Magazine Areas. If compared to the 2004 sampling exercise, the SAP proposes a number of samples that is approximately one third of those previously allocated. DTSC understands that there are multiple objectives designed into this phase of the investigation. However, we are concerned that the ratios of the two sampling events are out of balance for two areas of similar total acreage. We recommend the Navy expand the number of samples for arsenic in the four Magazine Areas.**

   Response: ~~The investigation of the Site 22 Magazine Area was designed to support a remedial investigation, which would include a human and ecological risk assessment. The investigation for Magazine Areas A through D is to support a Site Inspection level of study to evaluate whether there is evidence of a contaminant release. The Navy believes the current sampling design is adequate to determine whether an arsenic-containing herbicide was applied in Magazines A through D in a manner that results in elevated concentrations in soil. The number of samples proposed for Magazine Areas A through D is considered appropriate for the goals of the study.~~

The Navy has added 10 additional samples within the Inland Area Magazines A through D, as shown on Figure 3.

3. **Comment:** **DTSC supports the California Fish and Game recommendation to assess the drainage into the Clayton Canal from Surface Drainage Area G. This would be a minimal expansion of the objective to assess the sediments of Mount Diablo/Seal Creek for arsenic. Further support for this recommendation can be established from reviewing the sample results for arsenic taken by the Regional Water Quality Control Board during our January 14th site visit.**

Response: *Please refer to EPA specific comment 10. The Navy has added three surface sediment samples within Surface Drainage Area G (within the abandoned Clayton Canal).*

RESPONSES TO DFG COMMENTS

GENERAL COMMENTS

1. **Comment:** **The SAP should be revised to address the potential for arsenic-contaminated soil to enter the Clayton Canal, including an assessment of whether there are physical barriers or other structures along the canal that would prevent this from occurring. Assuming that there are no such barriers, fish populations and fish-eating predators in Clayton Canal, Contra Costa Canal, and other waters may be affected. The canal is a water conduit between Rock Slough and other elements of the Contra Costa Water District water delivery system. Fish populations previously known to exist in the Contra Costa Canal have included striped bass, white catfish, and other species indigenous to the Sacramento-San Joaquin delta. These species should be assumed to occur, unless evidence shows otherwise.**

Response: As discussed in EPA specific comment 10, the Clayton Canal has been abandoned and is covered with soil and vegetation. Thus, the canal does not provide habitat for fish.

No portion of the Site 22 Magazine Area or Magazine Areas B, C, and D drains toward the Contra Costa Canal, which is an active canal managed by the Contra Costa Water District. A portion of the Contra Costa Canal is located southwest of Magazine Area A, as shown on Figure 3. At this time, it is unknown whether arsenic is present in surface soil at Magazine Area A. The purpose of the soil sampling proposed in the SAP is to evaluate whether there may have been a release of arsenic at the site. If the sampling as proposed in the SAP indicates that arsenic is at elevated concentrations in surface soils, then additional investigations may be necessary.

According to the public information officer at the Contra Costa Water District, the Contra Costa Canal is 48 miles long. Surface water from the canal is treated at six different treatment plants, located in Oakley, Antioch, Pittsburg, Bay Point, Martinez, and Concord, California.

2. **Comment:** **Please consider including sampling in the Clayton Canal within Magazines A through D unless the surface flow model definitively shows that surface runoff would not enter the canal, particularly in Magazine B.**

Response: The purpose of sampling Magazine Areas A through D is to evaluate whether elevated arsenic is present in surface soils as a result of the possible application of an arsenic-containing herbicide. Soils at the site may contain no contamination. If the concentration of arsenic is elevated above background levels in soils, then sampling in the Clayton Canal may be necessary. Unless it is determined that arsenic is present at elevated concentrations in soil at Magazine Areas A through D, the Navy will refrain from sampling in the canal, which receives runoff from many upgradient sources.

3. **Comment:** **Please expand the scope of the currently proposed sediment sampling for the Inland arsenic study to include other analytes as mentioned in our previous memorandum dated February 23, 2005. DFG-OSPR recommends further sampling and evaluation of sediment in Seal Creek to address potential contamination from other Inland sites, particularly solid waste management units (SWMUs) 2, 5, and 18. Specifically, the study could be revised to include metals, pesticides, and TPH as analytes.**

Response: As discussed in EPA specific comment 7, samples collected for this investigation will be submitted for analysis of arsenic only. On June 14, 2005, the Navy submitted its draft final remedial investigation (RI) report for the SWMU sites. Although EPA provided comments on that document in a letter dated August 26, 2004, EPA did not dispute the report. Therefore, per the Federal Facility Agreement, as of July 14, 2005 the draft final RI report served as the final RI report for the SWMU sites. On November 1, 2004 the Navy sent a letter to EPA with the Navy's responses to comments, which regarded groundwater assessment.

4. **Comment:** **DFG-OSPR recommended that the SAP should be revised to address the potential for arsenic-contaminated soil to enter the Clayton Canal. The Navy acknowledges that contaminated soil could enter Clayton Canal, but proposes to do additional sampling only if necessary following this initial round of sampling. The Navy also will include a surface drainage diagram that illustrates the areas that may be sources to the Clayton Canal. These proposals are acceptable, but may result in additional sampling rounds at a future date.**

Response: Comment noted.

5. **Comment:** **A potential data gap identified by DFG-OSPR in our previous memorandum dated February 23, 2005 relates to potential contamination of Seal Creek from Solid Waste Management Units (SWMUs) 2, 5, and 18 that could be addressed through the current SAP. However, the Navy did not agree to expand the scope of the currently proposed sediment sampling for the Inland arsenic study to include other analytes for Seal Creek samples. The Navy's response was based on the U.S. Environmental Protection Agency comments on the draft final Remedial Investigation (RI) for Solid Waste Management Units (SWMUs) 2, 5, and 18, which focused on groundwater, and the lack of dispute by that agency. Agreement by a federal agency does not necessarily preclude further action to address state concerns, and additional sampling could still occur and be reported as an addendum or supplement to the SWMU RI.**

Response: Comment noted.

SPECIFIC COMMENTS

1. **Comment:** **<u>Page 1 (Project Description and Management)</u>. A brief description of Magazines A to D would be useful, since soil sampling at these munitions magazine areas is also part of the investigation. The scope of the investigation should be expanded to include the potential for arsenic contamination of Clayton Canal. Please expand the scope to include reference to the proposed arsenic sampling and a description of the historical use of arsenic-containing herbicides.**

Response: A description of Inland Area Magazines A through D has been included as paragraph 6 in Section 1.0.

2. **Comment:** **<u>Page 4, Figure 3</u>. It is unclear whether the locations proposed for surface sampling in Areas A to D were selected with a consideration of potential for surface runoff into Clayton Canal. This would be based upon gradient, distance to the creek, and perhaps other considerations.**

Response: The methodology for selecting the locations of proposed surface samples in Inland Area Magazines A through D is discussed in EPA general comment 1.

3. **Comment:** **<u>Page 10 (Physical Setting, Site Description, and Site History)</u>. This section should include a description of surface flow to the Contra Costa Canal. Please include a basic description of the habitat types and species of fish and wildlife found in the magazine areas, Seal Creek, and Clayton Canal. In addition, a brief reference of the wildlife management programs that exist in the Inland Areas would be helpful. In particular, the Concord Integrated Natural Resources Management Plan and the tule elk herd should be mentioned.**

Response: Information on habitat and wildlife found in the magazine areas, Seal Creek, and Clayton Canal has been added to paragraph 3 of Section 1.1.4.

A sentence to describe the Concord Integrated Natural Resources Management Plan has been added to the last paragraph of Section 1.1.4. Please refer to the last paragraph of Section 1.1.4 for the reference to the Tule elk.

4. **Comment:** **<u>Page 11, Figure 6 (Surface Drainage Map)</u>. Drainage into Clayton Canal should be accounted for in this figure. Please also include a figure similar to figure 6 that shows surface water flow in Magazines A through D.**

Response: Drainage into the Clayton Canal is indicated in "Area G" of Figure 6A. A figure that shows drainage within Inland Area A through D based on topography has been added as Figure 6B.

5. **Comment:** **<u>Page 12, Figure 7 (Proposed Sediment Sampling Location)</u>. We believe that this accurately indicates the proposed sampling locations.**

Response: Comment noted.

6. **Comment:** **<u>Page 19 (Phase I Remedial Investigation)</u>. Please provide additional information on the derivation of the ambient concentration for arsenic in soils at Site 22, and provide an assessment of whether it is impacted by widespread arsenic contamination.**

Response: The derivation of ambient concentrations for arsenic is discussed in Appendix A of the "Draft Final Remedial Investigation Report Inland Area Sites 13, 17, 22, 24A, and 27, Concord Naval Weapons Station, Concord, California," dated October 1997. Statistical outliers were removed from the data set as were sample points found to be in contaminated areas (for example, Site 22 near Building 7SH5).

7. **Comment:** **<u>Page 22 (Investigation of Arsenic in Soil at Site 22)</u>. Please identify the biotic tissue sampled in the bulleted list (e.g., plant, invertebrate).**

Response: The first bullet on page 22 will be revised to indicate that three plant tissue samples were collected and analyzed for arsenic.

8. **Comment:** **<u>Page 24 (Site 17 Remedial Investigation and Surface Water Ambient Water Monitoring Program)</u>. Please post the sample locations in Seal Creek and the analytical results that were collected with the Site 17 investigation and the Surface Water Ambient Water Monitoring Program (SWAMP) on a figure.**

Response: Figure 7 has been revised to include the sample locations and analytical results from samples collected within Seal Creek as part of the Site 17 Investigation and Surface Water Ambient Monitoring Program.

9. **Comment:** **<u>Page 25 (Project Objectives)</u>. The inclusion of at least one of the downstream Seal Creek sediment samples in the bioavailability analysis will be helpful in determining potential ecological exposure.**

Response: The purpose of the samples analyzed for bioavailability is to more accurately assess risks to human health. Although arsenic is a risk driver to human health in soil, arsenic was not identified as a risk driver to terrestrial ecological receptors in previous evaluations at the site (Tetra Tech 2003).

Samples in the creek are being collected in a phased approach. The first step is to evaluate whether concentrations of arsenic in the creek are above background levels. If concentrations of arsenic are elevated above background levels, additional investigations of the creek, including bioassays or evaluations of bioavailabilty, may be relevant.

10. **Comment:** **<u>Page 30, Table 4 (Data Quality Objectives)</u>. Please include in decision rule 3a that if arsenic concentrations in Magazines A, B, C, or D exceed ambient concentrations, both sampling of Clayton Canal sediment within these areas and the production of an ecological risk assessment may be necessary.**

Response: Decision rule 3a has been revised as follows:

"Decisions will be made individually for each of the four other Inland Area magazine areas included in this investigation. If arsenic in surface soil at any of the additional magazine areas exceeds the ambient level for arsenic, additional investigation may be warranted, as well as an ecological and human health risk assessment."

11. **Comment:** **<u>Page 30, Table 4 (Data Quality Objectives)</u>. The result of the decision rules 2b and 2c appear to be reversed. If arsenic is not above ambient concentrations upstream, but is elevated downstream of the magazine area, then an on-base source seems likely.**

Response: As discussed in EPA general comment 12, decision rule 2b has been revised.

12. **Comment:** **<u>Page 30, Table 4 (Data Quality Objectives)</u>. This section should be expanded to reflect the need to include sampling in Clayton Canal.**

Response: *As discussed in EPA specific comment 10, the Navy does not plan to sample Clayton Canal within Magazine Areas A through D. However, as agreed at the September 23, 2005, site visit, three samples will be collected at Site 22 within Drainage Area G, within the abandoned Clayton Canal.*

13. **Comment:** **Page 32, Table 4 (Data Quality Objectives). The field trip to determine arsenic sampling locations occurred in January 2005.**

Response: The text has been revised to indicate that the field trip occurred in January 2005.

14. **Comment:** **<u>Page 36 (Detection and Quantitation Limits)</u>. Please reference Appendix D where the reporting limits are presented.**

Response: A reference to the reporting limits in Appendix E has been added to Section 1.3.2.6.

15. **Comment:** **<u>Page 55 (Analytical Methods)</u>. Additional details on the leaching procedure are needed, either in the text or by including the protocol as an appendix. For example, at what pH and for how long will the leaching occur? For what type of organism (e.g., plant, invertebrate, or animal) does the leaching test estimate bioavailability? How does it compare to the neutral and acidic pH forms of the waste extraction test?**

Response: Please refer to EPA specific comment 9.

16. **Comment:** **<u>Page D-1, Table D-1</u>. Since only soil and sediment samples are being collected, please remove the information on reporting limits for arsenic in water samples.**

Response: Table E-1 has been revised to remove water reporting limits.

17. **Comment:** **All of DFG-OSPR's specific comments on the draft version were adequately addressed in the Navy's response to comments with the exception of the following comment.**

<u>Page 55 (Analytical Methods)</u>. The Navy provided the additional information on the leachability test that DFG-OSPR requested. The leachability test simulates the conditions of a young swine's stomach (e.g., pH 1.5) and has been shown to be a good model for bioavailability in human children. The relationship between arsenic solubility and pH is complex, and in some cases, arsenic can be more soluble in neutral or alkaline conditions than in acidic solutions (Masscheleyn et al. 1991; Yang et al. 2002). The uptake of arsenic by plants would occur at higher pH than that proposed to simulate the digestion in the stomach of humans (pH 1.5). Additional information is needed to support the assumption that arsenic solubility at low pH would exceed that at higher pH.

Response: *The Navy has collected plant tissues directly from the Site 22 Magazine Area that were analyzed for arsenic; arsenic was not detected in the samples collected. The Navy does not intend to use the information from the leachability test to draw conclusions about risk to plants. The laboratory will be instructed to follow the method specified in Appendix B. The Navy does not intend to research or alter the method at this time.*

RESPONSES TO WATER BOARD COMMENTS

GENERAL COMMENTS

1. **Comment:** **Water Board staff is concerned by the possible handling of ordnance within the magazines areas A through D. Please state if emergent chemicals such as perchlorate, nitrosodimethylamine, 1,4 Dioxane have been sampled in soils and groundwater at the site. Please review July 3, 2003 Water Board correspondence to fulfill this regulatory request.**

Response: No previous investigations have been conducted at Magazine Areas A through D, aside from the 1983 initial assessment study, which did not indicate any environmental releases (Ecology & Environment 1983). No known releases have occurred at Magazine Areas A through D to warrant sampling for analysis of the emergent chemicals noted by the Water Board. (See response to EPA specific comment 4.) The Navy is aware of the Water Board's concern regarding emergent chemicals and will sample and analyze for them, when appropriate for the site and investigation.

2. **Comment:** **Please list the groundwater beneficial uses for the site (see the 1995 San Francisco Basin Plan): http://www.waterboards.ca.gov/sanfranciscobay/basinplan.htm).**

Response: The existing beneficial use of groundwater for the Site 22 Magazine Area and Magazine Areas A through D, which are located in the Clayton Valley Watershed, is as a municipal and domestic water supply. This beneficial use is according to the San Francisco Basin Plan referenced above. (See Table 2-9 for the website link referenced above.) Several potential beneficial uses for groundwater were identified, including industrial process water supply, industrial service water supply, and agricultural water supply.

The beneficial uses for Mount Diablo and Seal Creek are municipal and domestic water supply, agricultural water supply, industrial process water supply, wildlife habitat, and cold and warm freshwater habitat.

These beneficial uses have been added to Section 1.1.4 of the SAP.

3. **Comment: Water Board staff collected several surface water samples at five locations on 1/14/05. Please include the analytical results from this sampling effort in the report.**

Response: The analytical data for the Water Board's surface water samples have been added to Figure 7.

4. **Comment: Indicate in the text the basis for not including sediment sampling locations within the Clayton Canal which is found to run through or by some of the magazine areas. Water Board staff is concerned that soils contaminated with arsenic may have been transported to the canal via a surface water pathway.**

Response: Please refer to EPA general comment 10.

5. **Comment: Please indicate that the Navy will coordinate with Water Board staff toward the closure of UST site 7SH5. Plot the detections made in petroleum hydrocarbons in soils and groundwater in a separate figure.**

Response: The Navy will work with Water Board staff toward closure of underground storage tank (UST) Site 7SH5 as part of the Navy's petroleum/UST program. Information about the UST Site 7SH5 will be included in the CERCLA RI report for Site 22 as appropriate.

6. **Comment: Board Staff recommends that a site specific leach test be conducted in a laboratory under hydrologically unsaturated and saturated flows conditions to determine the mobility of chemical of concerns. For example, the EPA Synthetic Precipitation Leaching Procedure could be used to determine the capacity of site's soils to leach Arsenic. It is important to determine in this study the Arsenic species distribution in site's soils. Arsenic toxicity is dependent on the chemical form found. Arsenites (As III) are more soluble than Arsenates (As V which comprises bacterially methylated organic arsenic species).**

Response: The Navy plans to evaluate the toxicity of arsenic at the site through the bioavailablity analyses. Since the application of arsenic was surficial, it is likely that the arsenic has been oxidized and is present as arsenate. Based on the data, significant concentrations of arsenic have not been detected in subsurface soils, suggesting that the arsenic is remaining tightly bound to surface soil. Arsenic has also not been detected in groundwater at the site.

7. **Comment:** **Water Board staff is concerned by the potential extensive spatial contamination of arsenic in soils at the site. Please clarify the basis for not considering a qualitative approach to characterizing arsenic impacts at the magazines in conjunction with the proposed sampling. Current technological advances in field equipment might enable the deployment of a complementary strategy for the areas not sampled.**

Response: Based on the distribution of arsenic in soil at Site 22, it appears that an arsenic-containing herbicide was used to control growth around the bunkers. Concentrations of arsenic away from and outside the bunker area were significantly lower, and were below background. The Navy does not see the value in sampling smaller subareas because concentrations across the site are elevated. The elevated concentrations of arsenic as a whole across the site will need to be evaluated.

Inland Area Magazines A through D have not previously been tested. As discussed in the response to EPA general comment 1, this initial phase of sampling will be used to assess whether arsenic-containing herbicides have been sprayed in these areas in a fashion similar to Site 22. If arsenic is detected at concentrations significantly above background, then additional testing may be warranted.

RESPONSES TO MR. GREGORY GLASER (RAB Member) COMMENTS

1. **Comment:** **Page 29 (Table 4, Step 5, part 1(b)), states, "If the cancer risk estimated from exposure to Arsenic in soil at the off-site properties exceeds the risk management range or if the non-cancer index exceeds 1, then it will be concluded that arsenic poses an unacceptable risk to human health, and in this case, additional analysis will be conducted to determine if there is any evidence that application of As containing herbicides at the magazine area is the primary source." For the "additional analysis" (as set forth at part 1(c)), I would offer that it may be inefficient (with respect to both time and cost) to wait and see if fence line concentrations are unacceptably high before sampling further out from the fence line, especially for the proposed sampling locations that are still very close to the fence line (e.g. the two proposed sample locations (7SHB185-86) adjoining a known arsenic concentration of 199 mg/kg).**

Response: As discussed in Section 1.1.5.10, the Navy asked ATSDR to review the soil data collected at Site 22 to assess any potential human health risks to neighboring properties. ATSDR concluded that incidental exposure to arsenic in the soil would not be expected to harm human health.

In addition, ATSDR concluded that if the source of arsenic is the Navy's application of herbicides, it is unlikely that concentrations in the neighboring yards would be higher than the maximum concentrations detected in soil at Site 22 where the actual spraying would have occurred. For these reasons, the Navy is conducting the sampling to provide a greater level assurance to the public.

The location with the 199 mg/kg detection of arsenic (boring 7SHSB153) is approximately 96 feet from the outer fence line. The scale on the figure makes the location appear closer to the fence line than it actually is. Arsenic concentrations generally decrease the closer one gets to the outer fence line, and the Navy suspects that the trend continues off the base.

2. **Comment:** **Page 29 (Table 4, Step 5, line 1(c)), states "Professional judgment will be used to weigh the strength of evidence that a significant spatial pattern of arsenic concentrations is present." At the RAB meeting on May 5, 2005 the regulators had an interesting discussion on this point but drew different conclusions regarding what to deduct about site history based on spatial patterns of Arsenic (i.e. what causes clusters of Arsenic versus what causes an even distribution of Arsenic). I believe the public would find it informative to see a more specific statement in the Final SAP on this point.**

Response: Unfortunately, the Navy has no records to confirm how the arsenic was applied at the site in the 1940s. Most likely, the herbicides were applied to the ground surface with a boom type ground sprayer attached to the back of a tractor. The Navy believes that the distribution of arsenic in soil at the site as shown on Figure 4 is consistent with a surface application of an arsenic containing herbicide. Arsenic is elevated in surface soil collected near the magazines, where the vegetation needed to be controlled, and diminishes with depth and distance away from the magazines. Other hypothesis can be offered but cannot be confirmed. Thus, the SAP has not been revised.

REFERENCES

Ecology and Environment Inc. 1983. "Initial Assessment Study of Naval Weapons Station, Concord, CA." June.

Tetra Tech EM Inc (Tetra Tech). 2002. "Integrated Natural Resources Management Plan and Environmental Assessment, Naval Weapons Station Seal Beach, Detachment Concord, California." March 20.

Tetra Tech. 2003. "Draft Supplemental Remedial Investigation Installation Restoration Site 22, Naval Weapons Seal Beach Detachment Concord, Concord, California." February 12.

U.S. Navy. 2004. "Resolution of Informal Dispute Confirming the Draft Final Sampling and Analysis Plan for Investigation of Arsenic in Soil at Installation Restoration Site 22 Integrated Natural Resources Management Plan and Environmental Assessment, Naval Weapons Station Seal Beach, Detachment Concord, California." March 15.